FM 43-12
10 NOVEMBER 1989

By Order of the Secretary of the Army:

CARL E. VUONO
General United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General United States Army
The Adjutant General

DISTRIBUTION:

Active Army, USAR, and ARNG: **To be distributed in accordance with DA Form 12-11 E, requirements for FM 43-12, Division Maintenance Operations (Qty rqr block no. 11 67) and FM 100-10, Combat Service Support (Qty rqr block no. 406).**

U.S. Government Printing Office: 1992 — 311 -831/61268

PREFACE

This manual provides the Army's doctrinal guidance on battlefield maintenance operations within Army of Excellence Divisions (heavy, light infantry, airborne, and air assault). The doctrine in this manual complements the basic doctrine of FM 100-5. Division maintenance operations are conducted within the framework of the Division Combat Service Support (CSS) Organization. The cornerstone of maintenance operations is the operator/crew supported by unit level and direct support maintenance personnel. This manual describes the mission, organization, and maintenance support concept used by divisional units in support of the AirLand battle, This manual is primarily designed for unit commanders, motor officers, shop officers, and maintenance managers within divisions. CSS commanders and staff personnel will use this manual when developing plans and conducting operations in support of divisional units.

The proponent of this publication is Headquarters, United States Army Training and Doctrine Command **(HQ, TRADOC).** Submit changes for improving this publication on DA Form 2028, Recommended Changes to Publications and Blank Forms, and forward to: **Commander, U.S. Army Ordnance Center and School, ATTN: ATSL-DTD-DLD, Aberdeen Proving Ground, Maryland 21005-5201.**

NOTE: Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

INTRODUCTION

The Army must be prepared to deploy, fight, and win in different locations and under a variety of conditions. We must be prepared to fight a modern, highly lethal mechanized force typical of the Warsaw Pact, and must also be capable of defeating lighter, well-equipped forces and insurgents or terrorist groups in any terrain or climatic condition. In Europe, Southwest Asia, and Northeast Asia, those forces most likely to be our enemy use tactics, organizational structure, and equipment patterned after those in the Soviet Union.

A detailed description of threat forces is contained in the following field manuals:

- FM 100-2-1, Soviet Army Operations and Tactics
- FM 100-2-2, Soviet Army Specialized Warfare and Rear Area Support
- FM 100-2-3, Soviet Army Troops, Organization, and Equipment

Opposing forces will rarely fight against orderly, distinct lines. The distinction between forward and rear lines will be blurred. Army maintenance units assigned to divisions will be located throughout the battlefield. Mechanics may be dispatched to the breakdown site wherever it occurs. They will be expected to diagnose and repair, recover, or evacuate disabled or battle damaged equipment. In order to perform this mission, they must be as mobile and survivable as the units that they support. Maintenance managers must be able to analyze the combat commander's intent, anticipate requirements, and task-organize maintenance assets to optimize support. Accomplishment of this mission will expose maintenance units to enemy air and ground forces, active reconnaissance, and unconventional warfare activities as well as enemy activity that directly targets CSS operations. All battlefield maintenance operations need to be planned and conducted by integrating both passive and active defense measures into support plans and operations orders, This manual will provide doctrinal battlefield missions, organization and location as well as command, control, and communications for maintenance operations.

Threat forces have the capability to deliver nuclear, biological, and chemical (NBC) attacks throughout the depth of the battlefield. Maintenance and other support units will face an increased risk of NBC attacks as well as a high probability of contact with contamination. Support units must be able to conduct operations in a contaminated environment and must be prepared to handle contaminated equipment and supplies. This manual includes doctrine for maintenance operations in an NBC environment.

Modern electronic countermeasures will make command and control difficult. There is also potential for the enemy to disrupt maintenance and supply systems that rely on automatic data processing equipment. This manual describes doctrinal measures to implement during periods of degraded communications and electronic warfare (EW).

The effect of terrain and climatic conditions on maintenance operations will be described.

The AirLand battle is the Army's approach to military operations against any enemy force. Success on the battlefield will depend on the maintenance manager's ability to support in accordance with (IAW) the basic tenets of the AirLand battle doctrine: initiative, agility, depth, and synchronization.

FIELD MANUAL
NO. 43-12

*FM 43-12
HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, DC, 10 November 1989

DIVISION MAINTENANCE OPERATIONS

Table of Contents

Page

Preface i
Introduction ii

CHAPTER 1. Maintenance Overview 1-1
2. Battle Support 2-1
3. Technical Assistance and External Support 3-1
4. Support Variations Based on Tactical Situation 4-1
5. Recovery and Evacuation. 5-1
6. Missle Maintenance 6-1
7. Conventional Ammunition Maintenance 7-1
8. Communications-Electronics (CE) Equipment 8-1
9. Supply Operations 9-1
10. Safety Responsibilities 10-1
11. Environmental Impact on Maintenance Operations 11-1

APPENDICES APPENDIX A (Battle Support Scenario) . . . . . A-l
GLOSSARY . . . . . Glossary- 1
REFERENCES References-1
INDEX Index-1

*This publication supersedes FM 43-1 2, 2 April 1986.

CHAPTER ONE

MAINTENANCE OVERVIEW

1-1. MAINTENANCE CONCEPT

Maintenance supports combat readiness and effectiveness of the Army by sustaining weapons' systems and equipment in a mission ready/operational condition as effectively, responsively, economically, and as far forward as the situation permits. Army maintenance keeps materiel in a mission capable condition, restores equipment to a serviceable condition, or updates and upgrades its functional utility through modification. Maintenance includes inspecting, testing, servicing, classifying, repairing, rebuilding, and overhauling. Maintenance is a service that is provided as part of the combat service support required to conduct and sustain combat operations.

1-2. MAINTENANCE MANAGEMENT

The maintenance management process includes forecasting, scheduling, production control, quality assurance, technical assistance and the provisioning of repair parts. Inherent in the maintenance management responsibility is the obligation to provide a safe environment while conducting maintenance operations. This responsibility is as important during field or combat operations as it is for garrison maintenance missions. Safety concerns must be addressed in standing operating procedures (SOP) and operations' orders. Maintenance management policies and procedures are contained in the Maintenance Management UPDATE which includes AR 750-1, DA Pam 738-750, and DA Pam 750-35. Divisional units utilize the Standard Army Maintenance System (SAMS) to collect maintenance data and provide management information to each level of command. Repair parts management policies and procedures for both using unit and direct support (DS) maintenance units are found in the Unit Supply UPDATE.

1-3. THE MAINTENANCE SYSTEM

The Army Maintenance System consists of four distinct levels of maintenance: unit, direct support, general support, and depot. Each level is unique and makes a different contribution to the overall system. Unit maintenance consists of those tasks performed by the operator and crew as well as mechanics assigned to the unit. DS maintenance is provided by modified table of organization and equipment (MTOE) maintenance units or tables of distribution and allowances (TDA) activities. DS maintenance is characterized by repair and return to the user. This support may be dedicated to certain customers or provided on an area basis. General support (GS) maintenance is located in echelons above corps (EAC) and performs repairs in support of the theater supply system. Depot maintenance is characterized by repair and return to the system at national level. Additional information regarding the maintenance levels and how they are organized is outlined in Table 1-1 on the following page.

Table 1-1. Levels of maintenance.

Unit	Organizational Support	Direct Support	General Support	Depot Operations
Who	• User	• Direct support maintenance units • Installation support maintenance shop	• General support maintenance units • Installation support maintenance shops	• TDA activities • Industrial-type activities • Commercial contractors
Where	• Equipment location • Organizational maintenance shops	• Mobile maintenance shops • Fixed shops in installations or units • Equipment location • Division, corps & echelons above corps	• Semi-mobile maintenance shops • Installation maintenance shops • Equipment location • Echelons above corps	• Fixed plant -type facilities • On site, on exception basis • CONUS
What	• Preventive maintenance checks and services • Inspections • Lubrication and cleaning • Preserving • Tightening • Alignments • Minor adjustments • Replacement of unit level components & assemblies • Replacement of piece parts • Evacuation of unserviceables	• Diagnose and isolate equipment/components & assemblies malfunctions • Adjust, calibrate, and aline components & assemblies • Repair defective end items and components • Operate a repaired exchange activity • Perform pollution evaluations of engine emissions • Light body repairs • Technical assistance • Evacuate unserviceables • ECOD • Apply DS level MWOS • Issue ORF	• Diagnose and isolate equipment & components & assemblies malfunctions to the internal piece part level • Adjust calibrate, align, and repair components & assemblies • Repair/modification of end items/components & assemblies to the internal piece part level • Heavy, body, hull, turret, frame repair • Collection & classification of unserviceable class VIII • Evacuate disposable material • Technical assistance	• Overhaul of end items/components & assemblies repairs requiring manufacturers tolerances • Repair requiring special environmental facilities • Nondestructive testing of used parts • Inspections/modifications requiring extensive disassembly or elaborate test equipment • Cyclic overhaul and special maint programs • Manufacture of parts not otherwise obtainable
How	• Diagnosis & isolation of malfunctions • Use of built-in test equipment, simple go/no-go indicators installed instrumentation and external diagnostic/fault isolation devices	• Replacement of components & assemblies and piece parts • Provide highly mobile maintenance support teams • Use of repairable exchange and operational readiness float	• Mobile maintenance support teams replacement of components & assemblies and performance of repairs not requiring restoration to original manufactuers tolerances or specifications • Operation of cannibalization point	• Wholesale level direct exchange • Restoration of unserviceables to prescribed levels of serviceability • Modernization of serviceable assets
Why	• Sustain materiel readiness	• Support of user unit materiel readiness	• Support of installation/command/local supply stocks; operational readiness float stocks of DS units, and repair and return to user programs	• Support of overall supply inventory • Support of GS units

1-4. MAINTENANCE ALLOCATION CHART

The maintenance allocation chart (MAC) designates overall authority and responsibility for the performance of maintenance functions on an item of equipment. [t consists of six columns that provide the following:

- Group number - column **1** lists group numbers which identify components, assemblies, subassemblies, and modules with the next higher assembly.

- Component/assembly - column 2 contains noun names of components, assemblies, subassemblies, and modules on which maintenance is authorized.

- Maintenance functions - column 3 lists functions to be performed on items listed in column 2. Maintenance functions will be limited to and defined as follows:

  Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

  Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing with prescribed standards.

  Service. Operations required periodically to keep an item in operating condition.

  - Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.
  - Align. To maintain or regulate, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.

  Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measurement, and diagnostic equipment (TM DE) used in precision measurement.

  Remove/install. To remove and install the same item.

  - Replace. To remove an unserviceable item and install a serviceable counterpart in its place.

  Repair. The application of maintenance services to restore serviceability to an item by correcting a specific fault, malfunction, or failure in a part, subassembly, module, end item, or system.

  Overhaul. That maintenance effort prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications.

  Rebuild, Consists of those services/actions necessary to restore unserviceable equipment to a like-new condition IAW original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment.

- Maintenance level - column 4 specifies the lowest level of maintenance authorized to perform the functions listed in column 3. This is done by listing a worktime figure in the proper subcolumn. This figure represents the man-hours required to do that maintenance function. The number of man-hours specified by the worktime figure represents the average time required to restore an item to a useful condition under field operating conditions. This time includes preparation time, troubleshooting time, and technical inspection/quality control time in addition to time required to perform the specific task. The symbol designations for the various maintenance categories and their relationship with the Army four level maintenance concept are as follows:

  C- Operator/crew .....**(UNIT LEVEL)**

  O- Organizational Maint. . . . . . **.(UNIT LEVEL)**

  F- Direct Support . . . . . **DIRECT SUPPORT**

  H- General Support . . . . . **GENERAL SUPPORT**

  D- Depot ..... **DEPOT**

- Tools and equipment - column 5 names by code those common tool sets and special tools and test and support equipment required to perform the designated function.

- Remarks - column 6 lists references to the note page at the end of the MAC.

The MAC is found in the 9-series technical manuals at the 20, 30, and higher levels. Some of the

recently fielded, highly complex weapons systems have published a separate manual for the MAC. In those instances, the technical manual has the same first eight digits as other 9-series technical manuals followed by MAC. For example, the MAC for the Ml tank is TM 9-2350 -255 -MAC. Table 1-2 provides an example of a MAC.

1-5. BATTLE DAMAGE ASSESSMENT AND REPAIR

The purpose of battle damage assessment and repair (BDAR) is to return disabled combat equipment rapidly to the operational commander by repairing, bypassing, or rigging components expeditiously to restore the minimum essential systems required for the support of a specific combat mission or to enable self-recovery.

These repairs will be temporary and may not restore full performance capability. Battle damage assessment (BDA) is a procedure to determine what is damaged, whether it is reparable, what assets are required to make the repair, and where the repair should be made. Battle damage repair includes any expedient action that returns a damaged part or assembly to a mission capable or limited mission capable condition, Actions taken for BDAR may in-

Table 1-2. Maintenance allocations.

MAINTENANCE ALLOCATION CHART

1 Group Number	2 Component Assembly	3 Maintenance function	4 Maintenance level* C	O	F	H	D	5 Tools and equipment	6 Remarks
05	COOLING SYSTEM —CONT								
0505	Fan Tower Assembly	Inspect		0 2					
		Test		0 2					
		Replace			0 3			35	A
		Repair		4 5				37	
		Overhaul					**		
06	ELECTRICAL								
0601	Alternator	Inspect		0 2					
		Test		0 2					
		Replace		2 0					B
		Repair			8 0				
		Overhaul					**		
0602	Voltage Regulator	Inspect		0 2					
		Test		0 2	0 7				
		Replace		2 0					
		Repair			1 0				
0603	Motor, Starting	Inspect		0 2					
		Test		0 2					
		Replace		2 0				49	
		Repair			2 4				
		Overhaul					**		

**Worktimes are included in DMWR

*C - Operator or crew
O - Unit maintenance
F - Direct support maintenance
H - General support maintenance
D - Depot maintenance

elude shortcuts in parts removal or installation, installation of components from other vehicles that can be modified, utilization of parts serving a noncritical function on the same vehicle, bypassing of noncritical components, expeditious cannibalization procedures, fabrication of parts, and use of substitute fuels, fluids, or lubricants. While anyone on the battlefield can perform BDAR, unit and DS mechanics and technicians in addition to their specialty are trained in assessing battle damage.

The operator/crew performs initial battle damage assessment and repair damage if possible. The commander makes the decision whether or not to utilize **BDAR** in lieu of normal maintenance procedures. Since it may not be possible to train BDAR techniques in peacetime using actual equipment, the best substitute is to train system-oriented mechanics to understand the theories and principles associated with weapon systems. BDAR manuals provide a single document for each weapon system that contains techniques that have proven effective. They are not meant to be all inclusive and are no substitute for an experienced mechanic who understands how a weapon system moves, shoots, and communicates. The BDAR manual is applicable for operator, unit maintenance personnel, DS maintenance personnel, and GS maintenance personnel. Manuals have been developed for major weapons' systems and are issued with the normal complement of technical manuals. BDAR manuals have the same first eight digits as other 9-series technical manuals associated with a weapons system. For example, the BDAR manual for the M1 tank is TM 9-2350 -255-BD.

CHAPTER TWO

BATTLE SUPPORT

SECTION I. MAINTENANCE SUPPORT CONCEPT

2-1. INTRODUCTION

Combat makes heavy demands on equipment. Weapons systems and other items are subjected to severe use. Even though time may be limited, the continued availability of equipment demands that the operator/crew continue to perform essential checks and services.

Support organizations are tailored to respond to changes in the units and weapon systems. Maintenance managers throughout divisions must coordinate to make maximum use of available resources. Maintenance work is performed as far forward as practical within the limitations of the commander's priorities, resources and time available, the tactical situation, and other factors. Recovery or evacuation moves inoperable equipment to the maintenance activity best suited for the repair, or to balance the work load of forward elements so that they can meet new requirements. Maintenance operations throughout the division must be mutually supportive for maximum effectiveness.

Maintenance support planning must anticipate requirements for personnel, equipment, and repair parts and the effective use of these resources. Support planning must also recognize the limitations maintenance units have in armor protection, mobility, and communications. These severely restrict the ability of maintenance support teams (MST) to keep up with combat elements and to survive in the forward areas. Specific maintenance support planning considerations include--

- Tactical situation.
- Time and distance factors.
- Backup support responsibilities.
- Command priorities for support.
- Critical weapons systems and repair availability.
- Proposed locations of maintenance control points.
- Changes in maintenance time guidelines.
- Changes in the cannibalization/controlled substitution policies.
- Overall work load.
- NBC defense and decon requirements.

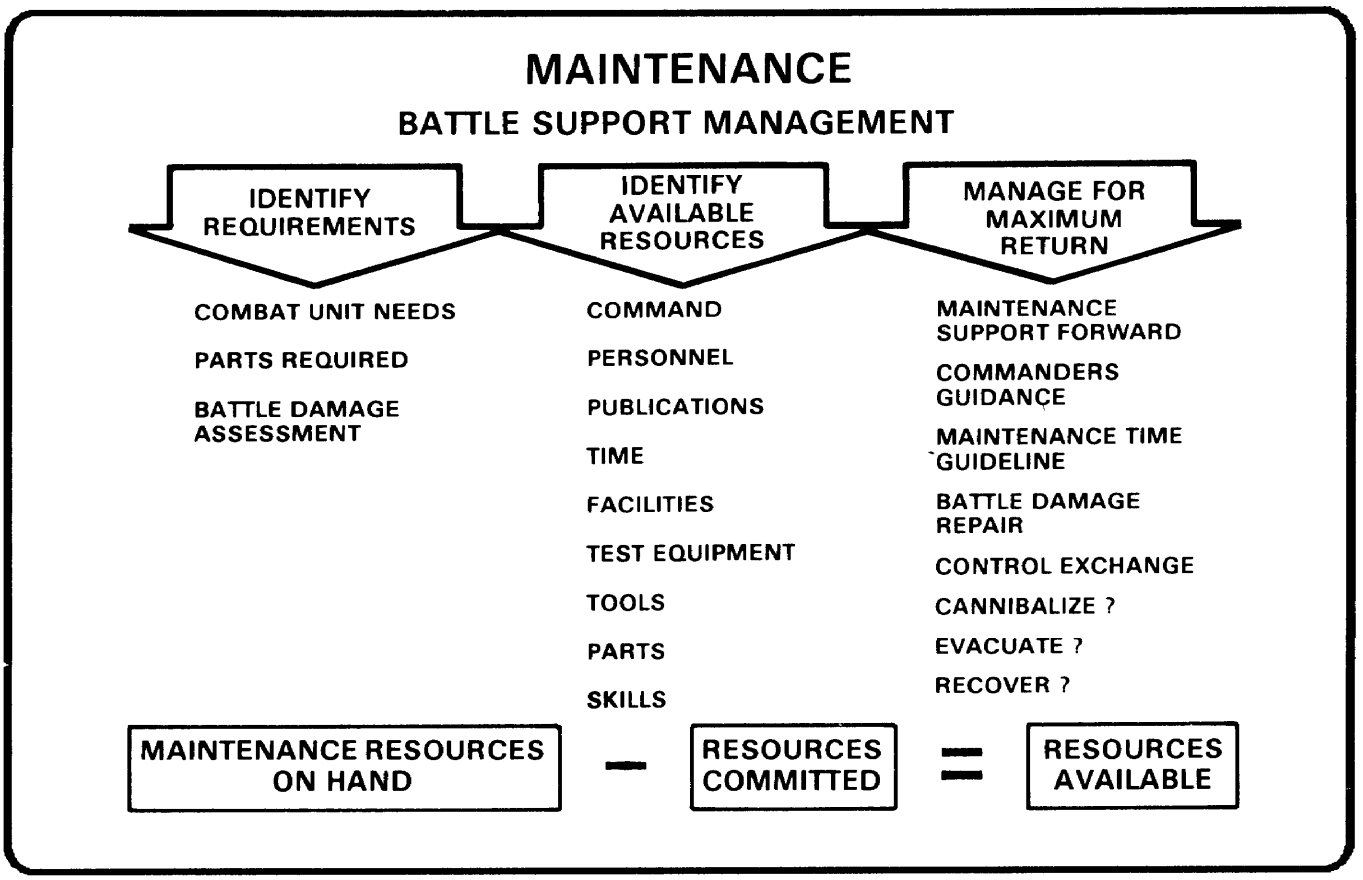

Figure 2-1. Battle support management

Figure 2-1 shows the basic concept for managing battle support maintenance. Before support can be provided, the requirement must be identified. When requirements have been identified, the maintenance manager must identify the resources on hand and the resources already committed. Available resources are then managed within the established support framework to return the maximum number of critical items to the battle. When a shift or change in priorities could provide a greater overall return, the maintenance manager takes appropriate action or makes recommendations through the chain of command.

2-2. CENTRALIZED CONTROL OF DECENTRALIZED OPERATIONS

Maintenance managers at all levels must retain control over the maintenance operations within their responsibility, even though the support is decentralized. This provides support as far forward as possible and focuses available maintenance resources on the work to be done.

The manager must be aware of both the maintenance work load and available resources in order to make good decisions. Since the situation may change rapidly, information must be as near real time as possible.

The manager must direct the application of maintenance resources or shift the work load to the maintenance elements best suited to do the repair. Damaged equipment awaiting repairs on one part of the battlefield, while maintenance personnel are idle on another, must be avoided.

Communications and accurate reporting are essential. The maintenance reporting systems provide responsive information, but must have timely and accurate input to make them work. In addition, automated information systems are subject to EW countermeasures and disruption by electromagnetic pulse (EMP). Alternative means of communication and reporting must be available to maintain continuity of operations.

Maintenance personnel must be prepared to act independently in the absence of instructions caused

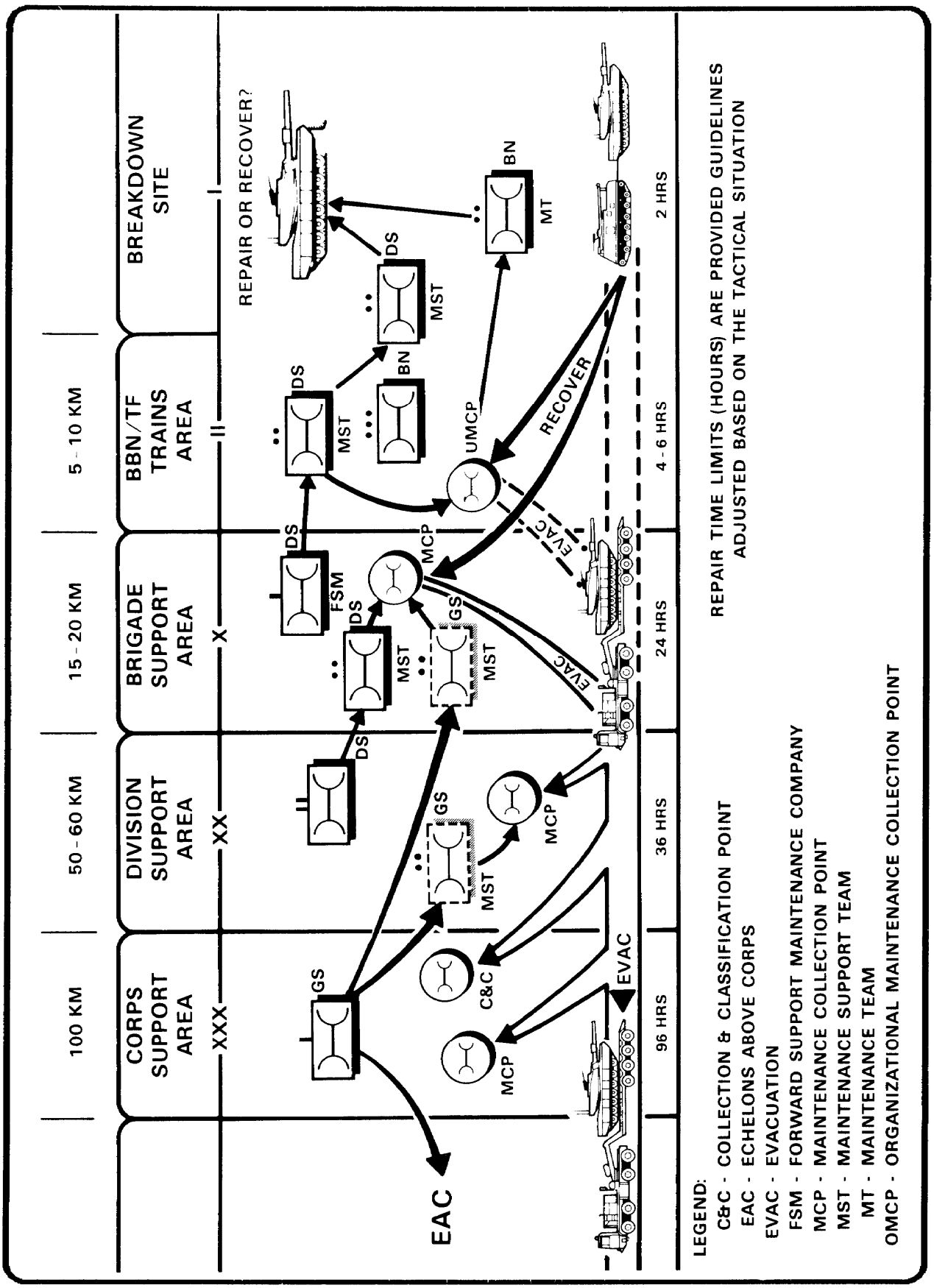

Figure 2-2. Maintenance on the battlefield.

by lack of communications. They must use professional judgment, guided by experience, to respond to changes in the maintenance situation and the needs of the supported unit.

2-3. REPAIR VERSUS RECOVERY

When equipment becomes inoperable, the applicable manager must decide whether to repair it on site or to recover it to a maintenance activity.

Whenever possible, repair equipment on site. This uses the least amount of resources and gets the equipment back to the user in the least amount of time. On-site repair, however, may not always be practical, The tactical situation; extent of damage; availability of personnel, tools, and repair parts; and other factors may make it more advantageous to recover the equipment, The repair versus recovery decision must be made on a case-by-case basis.

2-4. SELECTING REPAIR LOCATION

MACs and past experience provide estimated repair times. The estimated time can be compared to maintenance time guidelines for an indication of the location best suited for the repair

. Other factors, including the tactical situation, criticality of the equipment, work load, and possibility of MST repair further forward, should also be considered. Figure 2-2 on the previous page displays the repair, recovery, and evacuation decision process.

2-5. MAINTENANCE TIME GUIDELINES

Maintenance Repair Time Guidelines. Time guidelines are established to assist maintenance leaders in deciding where to repair equipment. This prevents equipment from accumulating in the forward area and aids in distributing the maintenance work load. Repair/ recover/evacuate decisions are made at all levels based on the time required to repair.

Times are based on command policy and the factors of METT-T. The guidelines are considered flexible and not restrictive. They begin with the completion of the diagnosis made by operator and crew and end when the equipment is returned to battle. They do not include evacuation, preparation, and movement time. Table 2-1 illustrates maintenance repair time guidelines.

2-6. MAINTENANCE IS A COMMAND RESPONSIBILITY

Commanders must ensure that equipment issued to their units is serviceable and combat ready and that it is properly used, maintained, and accounted for. Commanders are responsible for:

- Advising higher commanders of their equipment replacement and maintenance support requirements.
- Complying with instructions and procedures for preventive maintenance checks and services (PMCS), training, and allocating sufficient time for performing PMCS.
- Maintaining equipment to the Army's -10/-20 maintenance standard [AR 750-1].

Table 2-1. Maintenance time guidelines.

LOCATION	HOURS
ON SITE	2
COMBAT TRAINS/UNIT MAINT COLLECTION	6
BRIGADE SUPPORT AREA (BSA)	24
DIVISION SUPPORT AREA (DAS)	36

2-7. MISSION ESSENTIAL MAINTENANCE OPERATIONS (MEMO)

During combat, only maintenance needed to return equipment to mission capable status is performed. This concentrates the maintenance effort on those areas which affect the outcome of the battle, Nonmission essential maintenance is deferred until after the battle. Sometimes a weapon system may contain redundant systems which enable it to operate even when one or more of these systems are damaged. Commanders may decide to keep a weapon system in the battle at a reduced capability rather than to lose it entirely while the faulty system is repaired.

2-8. WEAPON SYSTEM REPLACEMENT OPERATIONS (WSRO)

The maintenance effort in support of combat operations is closely coordinated with WSRO. The aim of WSRO is to place a crewed, fueled, armed, ready-to-fight weapon system in the hands of the user. To do this the maintenance, supply, personnel replacement, and transportation activities must be coordinated. This is done by weapon systems managers (WSM) from each level of command as follows.

Battalion. The battalion/task force executive officer (XO) is normally the WSM. The battalion WSM allocates weapon systems to companies based on unit losses, assets available, and the com- mander's priorities. After cross leveling surviving crews and combat vehicles at the lowest level, the company and battalion WSMs forward their requirements using the weapon system status report.

Brigade. The XO maintains weapons systems information. However, because the brigade is a tactical rather than administrative headquarters, the brigade's operational involvement is usually limited to establishing priorities.

Division. A WSM is appointed within the DMMC and works with a personnel warrant officer or NCO designated by the division G-1. The WSM must coordinate with the materiel officer in the DMMC to obtain the number of weapons systems in DS maintenance units.

2-9. IMPLEMENTING BATTLE DAMAGE ASSESSMENT AND REPAIR

As discussed in Chapter 1, BDA involves inspecting damaged equipment to determine the extent of damage, classifying the equipment according to the type of repairs required, and developing a plan of action for each item. Priorities for repair of battle damaged systems are usually as follows:

- Most essential to completion of the immediate mission.
- Can be repaired in the least time.
- Repairable, but not in time to continue the immediate mission.
- Damaged beyond repair; possible candidate for cannibalization,

Battle damage repair (BDR) uses emergency expedient repairs to return the system to a fully or partial mission capable status. Under combat conditions BDR may sometimes be performed on fueled and/or armed systems. Other precautions may be waived by the commander.

2-10. CONTROLLED EXCHANGE

Controlled exchange is the systematic removal of serviceable parts from unserviceable, economically repairable equipment, in strict compliance with the division commander's published guidance, for immediate use to restore a like item to combat serviceability. It expedites a repair-and-return-to-user operation in support of materiel readiness or operational effectiveness.

During periods of combat or transition to combat, major Army commanders may modify the peacetime provisions of AR 750-1 to best meet the command's mission requirements.

2-11. CANNIBALIZATION

During combat, cannibalization is an important source of supply of critical repair parts. Cannibalization provisions for periods of combat and transition to combat must be developed by major Army and subordinate commanders. In general, these provisions should outline the circumstances, items of equipment, and the level of repair at which cannibalization will be practiced. Since prime cannibalization candidates are items damaged beyond repair, and since this determination is made at the DS level, routine cannibalization operations should be controlled at the support level. Cannibalization during peacetime is performed only by authorized activities IA WAR 710-1, AR 710-2, and DA Pam

710-2-2. Cannibalization of organic equipment by using units operating in a peacetime environment is not authorized,

2-12. REPAIR AS FAR FORWARD AS POSSIBLE

To maximize unit combat readiness, equipment must be repaired and returned to the user. Evacuation of equipment to maintenance points removes equipment from using units and increases the time equipment is not available. Repairing equipment as far forward as possible reduces transportation requirements and time, and increases equipment availability.

2-13. ENSURE UNIT EQUIPMENT IS AVAILABLE

COMMANDERS MUST ENSURE THAT THE DEGREE OF MAINTENANCE PERFORMED IS CONSISTANT WITH TECHNICAL AND TACTICAL REQUIREMENTS.

Materiel readiness is the direct product of an effective maintenance program. The commander's goal must be to have an operational ready unit capable of its wartime mission.

2-14. ORGANIZATIONAL FLEXIBILITY

Unit maintenance managers must be aware of changing support requirements and must tailor maintenance resources to ensure support is provided as required. Restructuring maintenance teams or requesting assistance from supporting maintenance units should be made as required.

2-15. REPAIR ONLY AS NEEDED

Commanders must ensure that the degree of maintenance performed is consistent with technical and tactical requirements.

2-16. USE MAINTENANCE RESOURCES PROPERLY

Assigned personnel, tools, equipment, and other resources must be used according to standard Army supply and maintenance procedures. Diversion of resources and deviation from standard procedures reduces maintenance effectiveness.

SECTION II. ORGANIZATION FOR SUPPORT MAINTENANCE FORWARD OF THE BRIGADE SUPPORT AREA (HEAVY DIVISION)

Maintenance managers, at all levels within heavy divisions as well as all CSS operators and planners, must understand task force organization and functions in order to provide timely support. CSS func-

tions are consolidated at task force level. This allows company/team commanders to concentrate their efforts on fighting. Companies will receive CSS assets only as needed to accomplish a specific task. Otherwise, CSS assets will be kept under the control of the battalion/task force maintenance section.

2-17. UNIT LEVEL MAINTENANCE

The battalion maintenance officer (BMO) controls the maintenance assets within the battalion. Class IX and The Army Maintenance Management System (TAMMS) operations are centralized at the battalion maintenance section within most maneuver battalions.

Unit integrity of repair parts and records is maintained. Each company's prescribed load list (PLL) is uploaded. High usage items in support of major weapons systems are positioned in the unit maintenance collection point (UMCP) and sent forward with the company maintenance team. The remainder of the PLL remains at the field trains.

As the battalion task organizes, the BMO releases maintenance assets for those companies that are detached and accepts maintenance assets from attached companies. It is imperative that the BMO ensures that adequate personnel, tools, maintenance and recovery vehicles, test equipment and manuals are on hand so that he can task organize the maintenance platoon to support the task force combat requirements. The BMO is concerned with providing maintenance support at three locations: the manuever company, the UMCP, and the battalion field trains. Normally, the BMO will attach a company maintenance team with authorized personnel and equipment to each company. This attached company maintenance team provides recovery and quick-fix capability to the manuever company. The intent is to provide on-site repair capability for those repairs requiring less than two hours and recovery capability back to the UMCP or other maintenance collection points for those items requiring more extensive repairs,

At the UMCP, repairs that require four to six hours are accomplished, A goal is to repair all but the most severely battle-damaged weapons systems, either on site or at the UMCP, Figure 2-3 presents a method of organizing a UMCP.

Since the majority of the battalion's wheeled vehicles will be located in the field trains, units may choose to operate a split PLL section. This means holding wheeled vehicle repair parts in the field trains along with some quantities of tracked vehicle repair parts items.

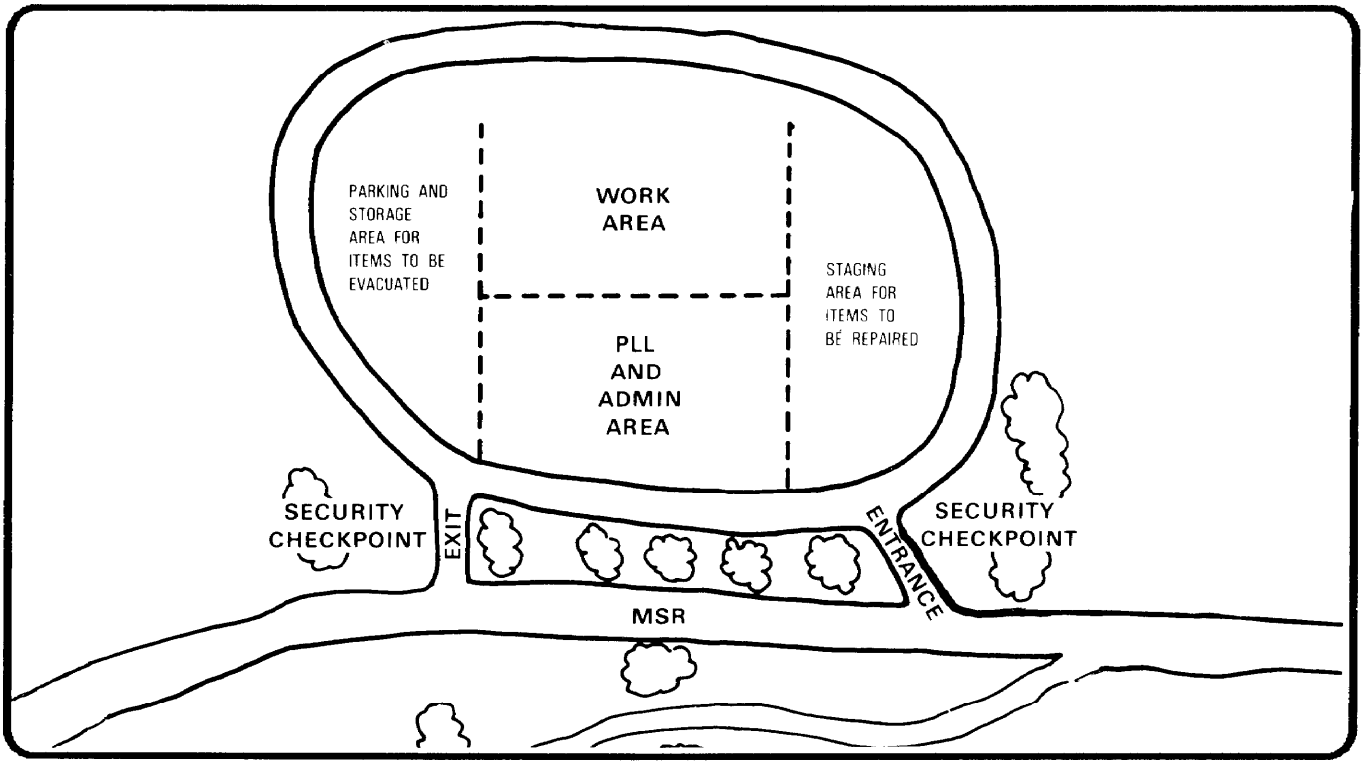

Figure 2-3. Layout of the UMCP.

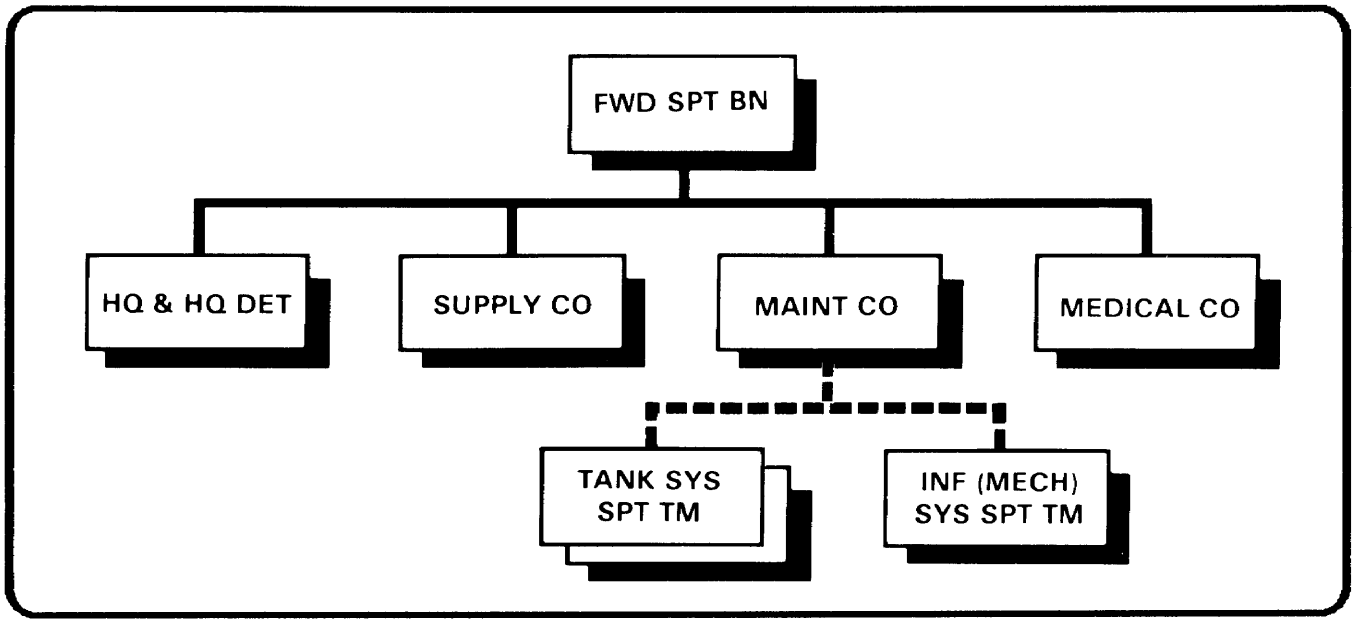

Figure 2-4. FSB organization.

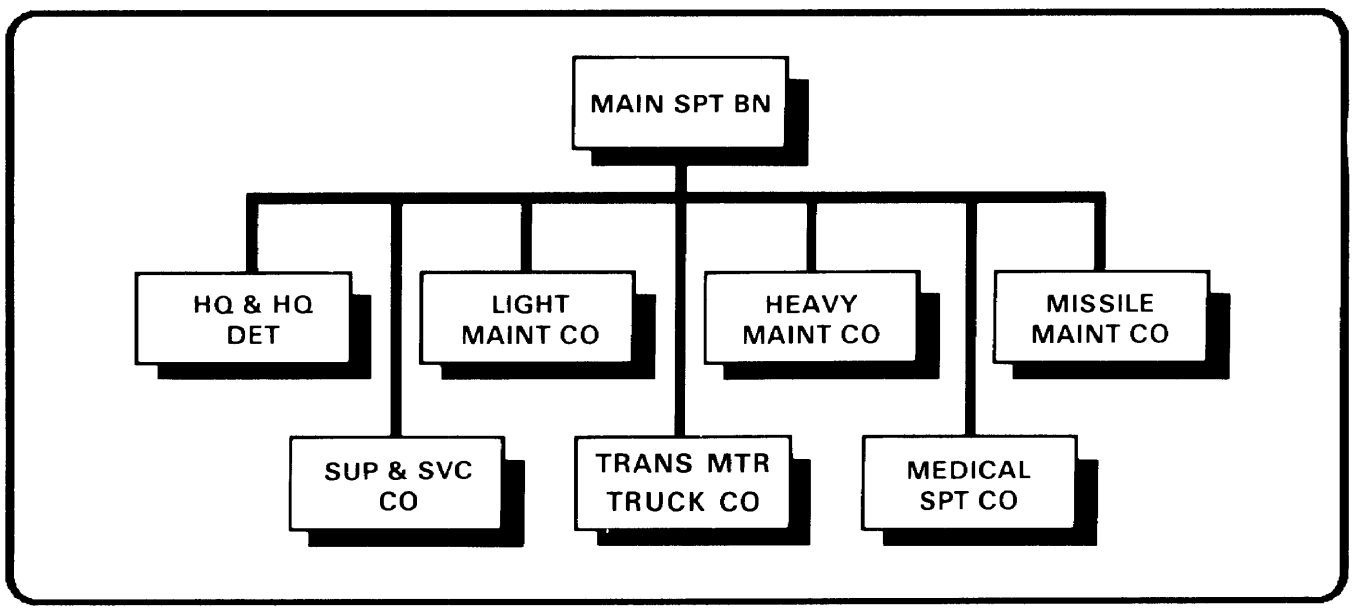

Figure 2-5. MSB organization.

2-18. DIRECT SUPPORT MAINTENANCE

Direct support maintenance within the heavy division is provided by forward support battalions (FSB, Figure 2-4) and the main support battalion (MSB, Figure 2-5) assigned to the DISCOM (Figure 2-6).

Battlefield maintenance support integrates unit and direct support level maintenance. This integration occurs at the UMCP and is accomplished using MSTs assigned to the forward support maintenance company. The mission of the forward support maintenance company is to provide dedicated DS maintenance to a maneuver brigade. The maintenance company TOE provides mobile system support teams that are authorized on the basis of one per maneuver battalion. The authorization is based on supporting a pure battalion (armor or infantry). As the battalions task organize, the maintenance company commander task organizes his system- support team assets into an MST capable of supporting a task force. This MST is sent forward to the UMCP. The

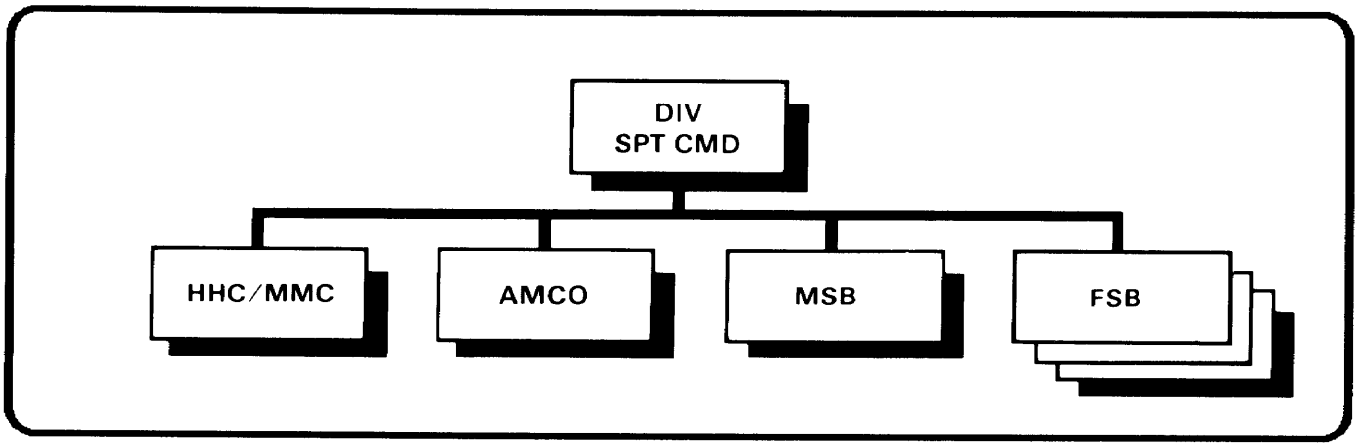

Figure 2-6. DISCOM organization.

team remains with the UMCP, is integrated into the UMCP defense plan, and receives routine administrative logistics support from the task force. Elements of the team may be sent forward to the breakdown site and, while the team is capable of performing more extensive repairs than the company maintenance team, they adhere to the same time limitations, that is, 2 hours on site and 4 to 6 hours at the UMCP. Figure 2- 7 shows how SST assets can be task organized into MSTs to support task force operations.

2-19. MAINTENANCE IN THE BRIGADE SUPPORT AREA (HEAVY DIVISION)

The BSA consists of battalion task force field trains, the brigade S1/S4 administrative/logistic center, and the FSB. A maintenance collection point (MCP) is established at each of the field trains sites.

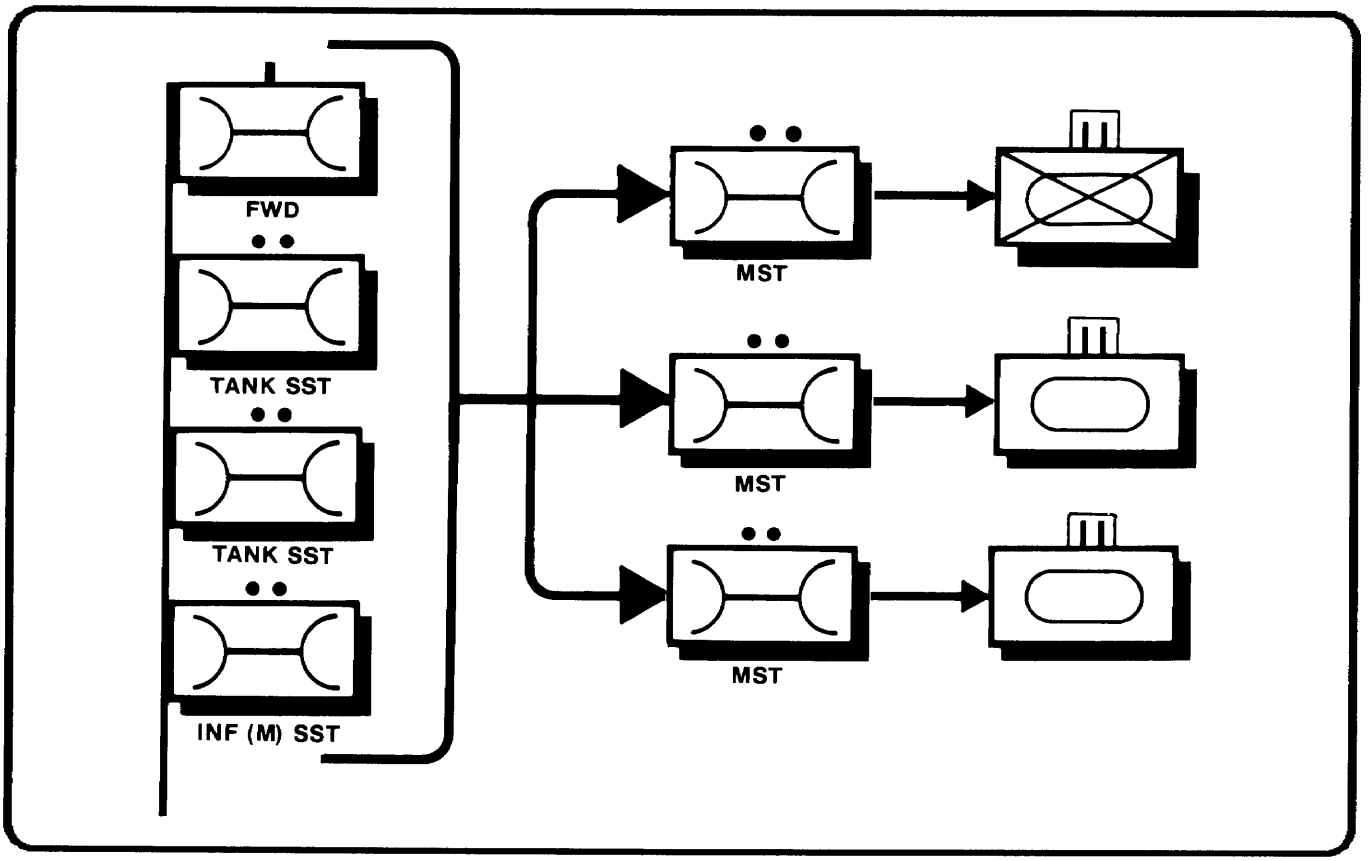

Figure 2-7. SST's task organized into MST's.

Again, unit level and DS level maintenance personnel work together to accomplish repairs within time guidelines. Repairs that can be completed within 24 hours are accomplished in the BSA. The majority of work on both wheel and track vehicles performed by the forward support maintenance company is performed at the MCPs either in the combat trains or the field trains.

The forward support maintenance company retains an automotive repair section as well as an armament repair section, ground support equipment repair section, electronic equipment repair section, and a missile maintenance repair section. The company also maintains an authorized stockage list (ASL), Figure 2-8 depicts a BSA.

THE FORWARD SUPPORT MAINTENANCE COMPANY RETAINS AN AUTOMOTIVE REPAIR SECTIONAL WELL AS AN ARMAMENT REPAIR SECTION, GROUND SUPPORT EQUIPMENT REPAIR SECTION, ELECTRONIC EQUIPMENT REPAIR SECTION, AND A MISSILE MAINTENANCE REPAIR SECTION.

The remainder of the battalion maintenance platoon is located at the field trains, normally working under the direction of the battalion motor sergeant, The focus of the field trains maintenance personnel is the repair of wheel vehicles, support equipment, and tracked vehicles requiring extensive repairs.

2-20. MAINTENANCE IN THE DIVISION SUPPORT AREA (HEAVY DIVISION)

The MSB provides DS maintenance support for units operating in the division rear. To provide a one-stop operation for supported units, MSB maintenance companies should be collocated as much as possible IAW dispersion requirement based on METT-T.

The maintenance companies in the MSB operate on the TOC/LOC concept, meaning the maintenance control section is the command, control and communications center for the companies. The maintenance control sections will have wire and FM communications to the support operations office [S00] and the S2/3 in the MSB.

The maintenance units in the MSB are 70-percent mobile and require transportation augmentation in order to relocate. The maintenance companies retain an emergency repair capability while moving, but technical supply operations for the division will be disrupted for a minimum of 24 hours.

Maintenance companies in the MSB should be able to break down, upload, and prepare to move within 4 to 6 hours after receiving the order, The companies should be able to receive work requests immediately upon arrival into a new area, and all maintenance and Class IX operations should be fully

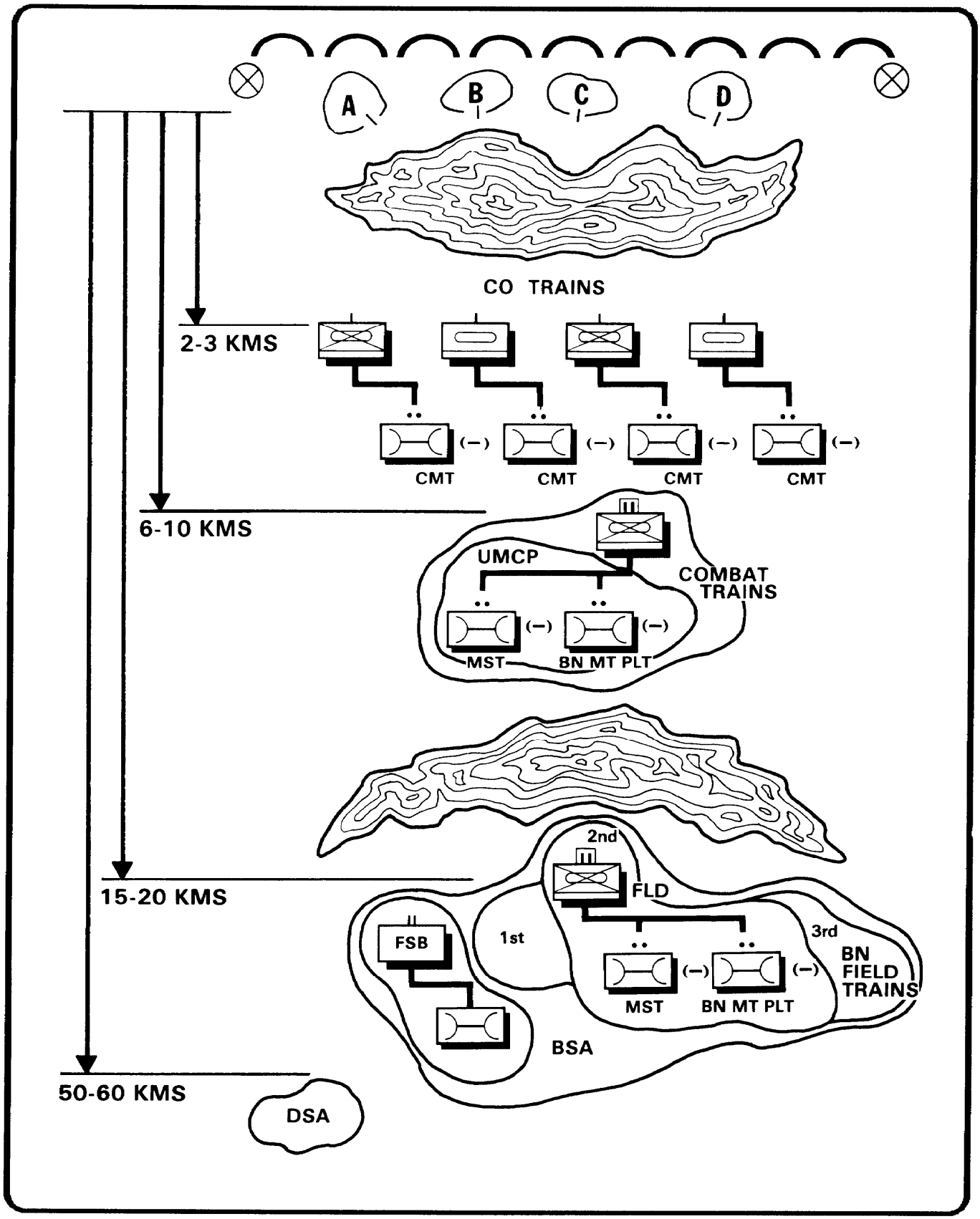

Figure 2-8. Brigade support area.

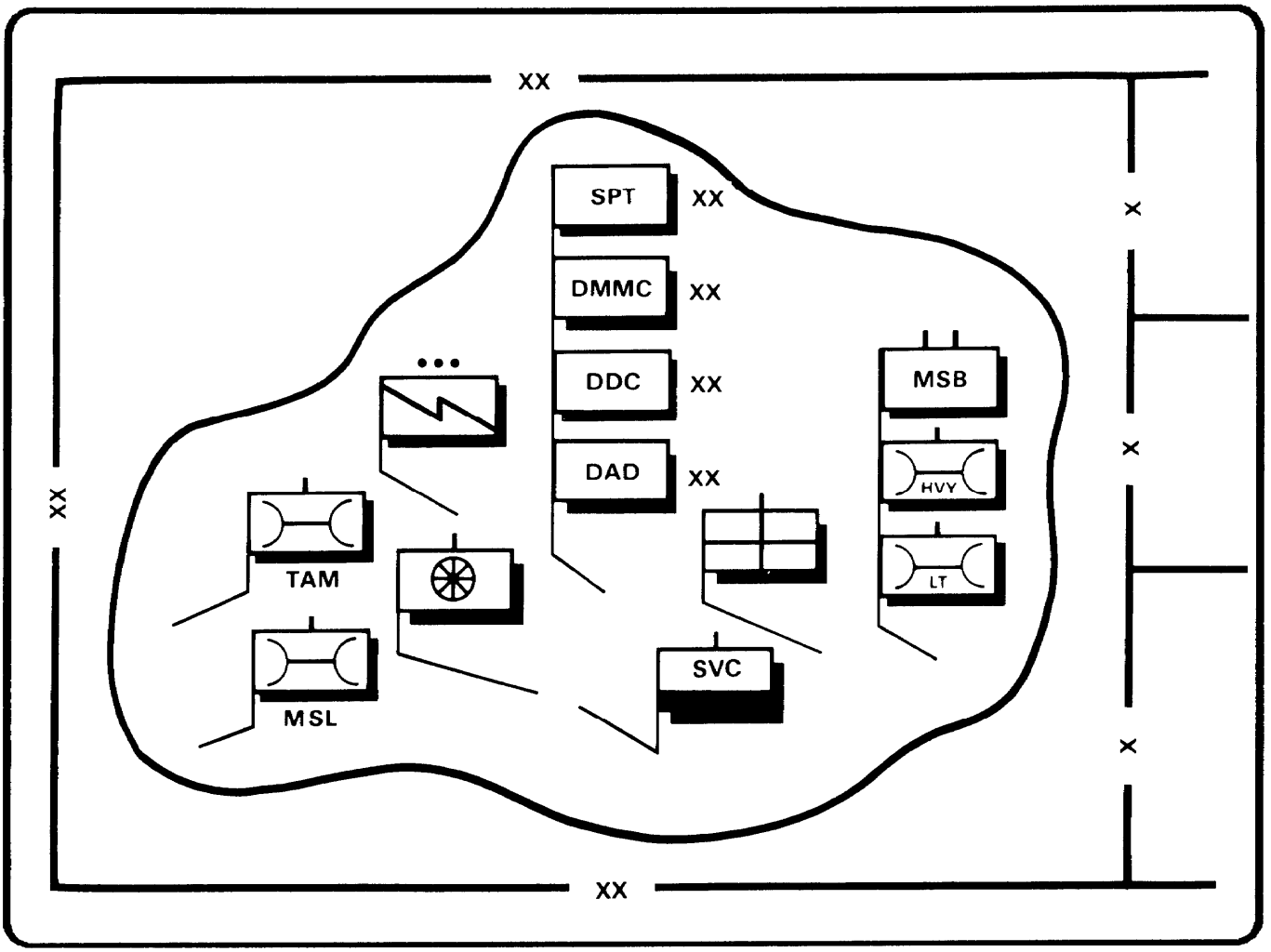

Figure 2-9. Division support area

THE MANAGEMENT OF MAINTENANCE AND SUPPLY OPERATIONS BEGINS WITH THE BMO.

operational 12 hours after arriving at a new site. Figure 2-9 depicts a DSA.

2-21. MAINTENANCE MANAGEMENT WITHIN THE DIVISION

The management of maintenance and supply operations begins with the BMO. The BM0 controls all unit level mechanics and coordinates support from the DS maintenance mechanics assigned to the MST. The MST NCOIC establishes a mini-maintenance control section at the UMCP, capable of tracking work requests and repair parts requirements and resupply. The MST NCOIC reports information and requirements to the maintenance control section in the BSA. The MST is also the quality control for all DS level maintenance performed in the UMCP and on site. The MST NCOIC is also the primary link between the BMO and the shop officer. Class IX requirements are received on DA Form

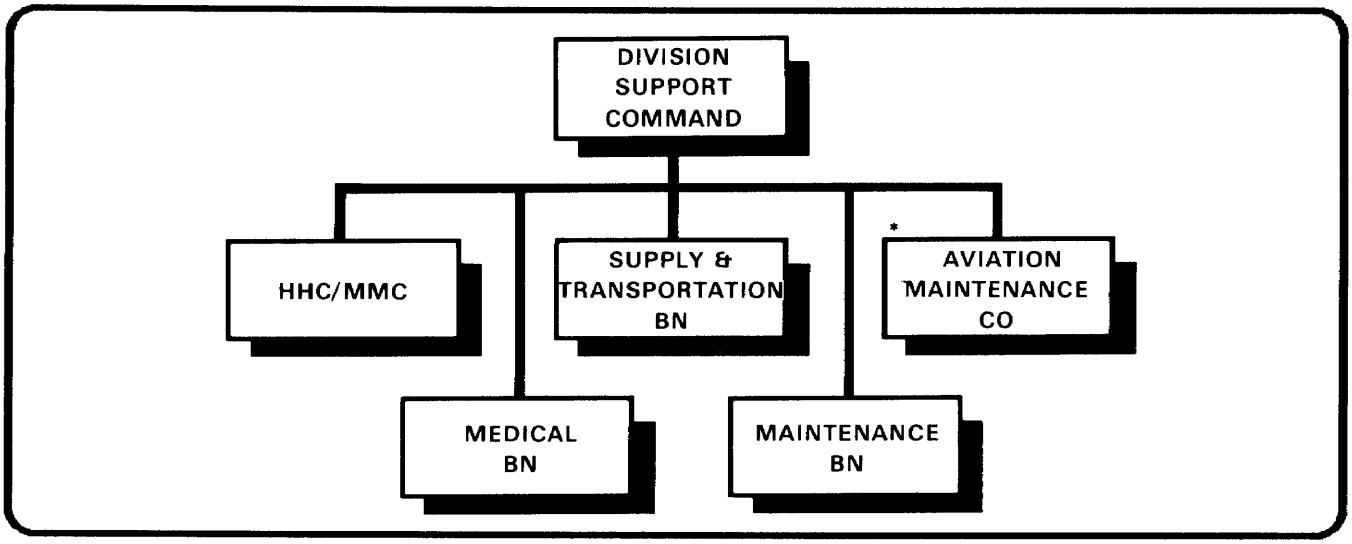

Figure 2-10. Airborne/Air Assault DISCOM.

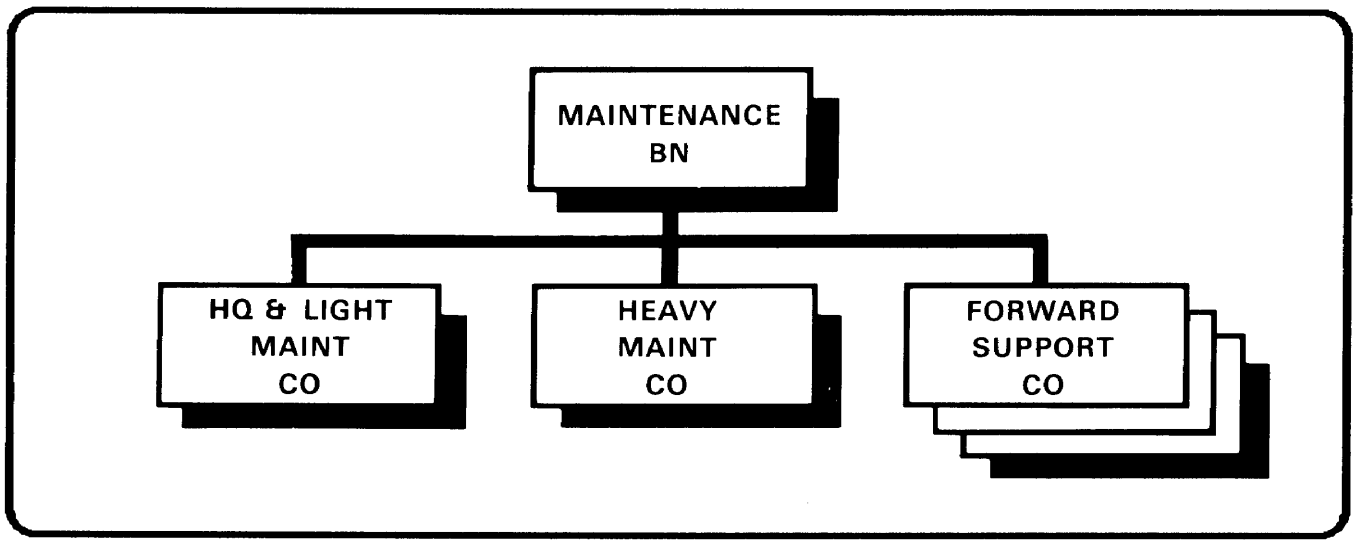

Figure 2-11. Maintenance battalion (Airborne/Air Assault DISCOM).

2404 from the operator/crew company maintenance team. DA Forms 2404 are consolidated by the company first sergeant and are brought to the UMCP. At the UMCP, requests are entered on the unit level computer (DA Form 2765 used for units not operating with the unit level logistics system). The floppy disc from the ULLS computer is then brought to the Tech Supply in the maintenance company and entered into the TacticaI Army Combat Service Support Computer System (TACCS). Requests for serviceable reparable will be accompanied by the unserviceable part as well as a request for issue and a request for turn-in, unless the item is for initial issue. If the unserviceable repairable is not available, procedures in AR 735-5 apply.

2-22. AIRBORNE/AIR ASSAULT DIVISION MAINTENANCE

Air assault and airborne divisions have functional battalions that provide CSS to the division. Figure 2-10 provides the organization of the DISCOM. Figure 2-11 provides the organization of the Maintenance Battalion. Forward area support teams (FAST) are established that provide dedicated CSS to the brigades. The forward area support team (FAST) consists of a medical company, a maintenance company, and elements from the supply and transportation battalion, A Forward Area Support Coordination officer (FASCO) serves as the single point of contact to coordinate brigade CSS.

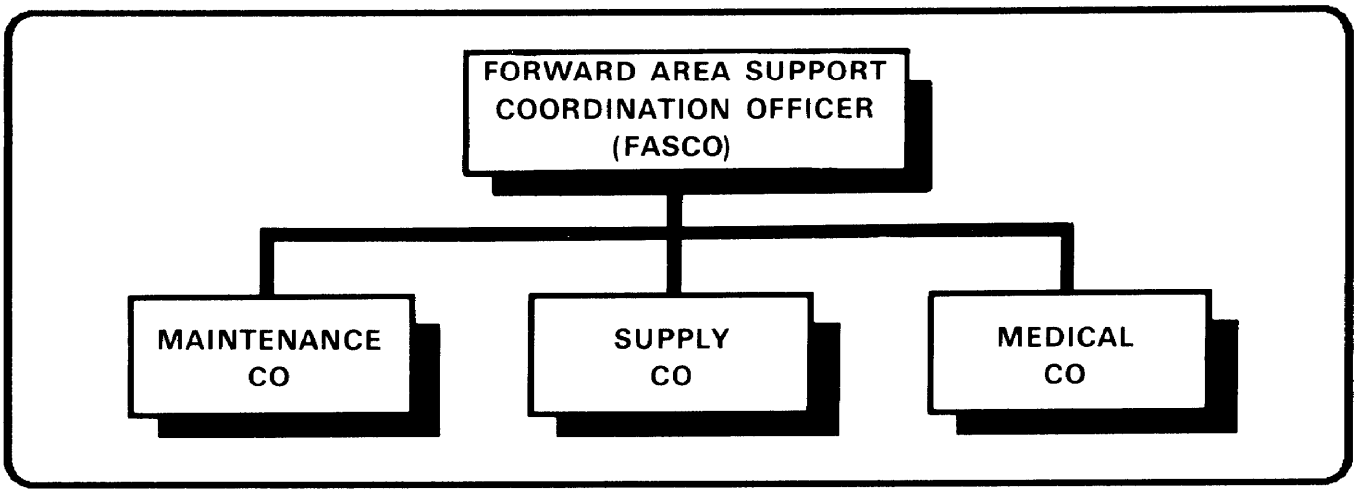

Figure 2-12. Forward area support team.

A typical FAST is shown in figure 2-12. DS maintenance and Class IX support are provided to the brigade by the forward support maintenance company. The company supports from the BSA and dispatches contact teams forward as needed. Because the support teams operate out of the BSA, the BSA is established as far forward as possible (approximately 15 km from the FEBA).

Because of the close proximity to the FEBA, the BSA must be fully prepared to engage and defeat enemy forces. The FASCO normally establishes the TOC/LOC for the FAST at the maintenance control section of the forward support maintenance company. The maintenance company commander **develops defense plans for the FAST and commands the reaction force (drawn from all elements in the FAST). The FAST has to remain mobile and be** capable of displacing within one hour after receiving the order to move. Repair parts, vans, and maintenance shops remain uploaded.

BECAUSE OF CLOSE PROXIMITY TO THE FEBA, THE BSA MUST BE FULLY PREPARED TO ENGAGE AND DEFEAT ENEMY FORCES.

2-23. DIVISION SUPPORT AREA

The remainder of the maintenance battalion is located in the DSA. The maintenance battalion normally establishes operations approximately 40-50 km from the FEBA. Units in the DSA are 70-percent mobile and require two to four hours to move.

2-24. LIGHT INFANTRY DIVISION MAINTENANCE

The light infantry division [LID] is organized for rapid deployment and presents planners with multiple employment options. The division may deploy in support of contingency operations into areas where there may not be US or allied bases. Thus, planners

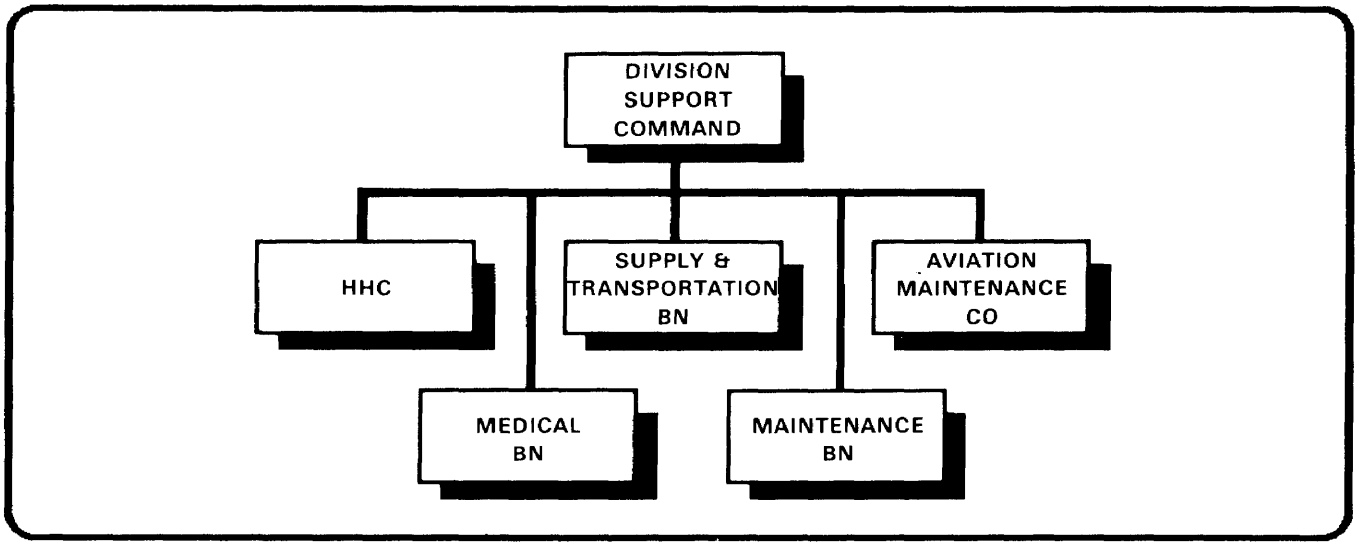

Figure 2-13. LID 131 SCOM.

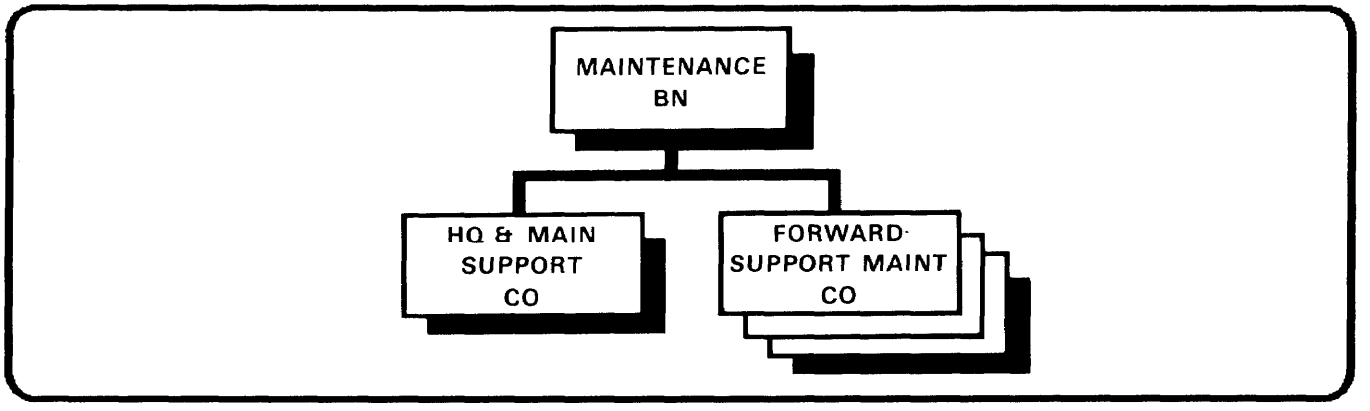

Figure 2-14. LID maintenance BN.

in the contingency deployment have to look at the most probable type of operation while retaining the ability to change organization and tailor the force to meet the mission.

To enhance the deployability of the LID, the division uses commonality of vehicles, weapon systems, and equipment. This streamlines maintenance operations and simplifies repair parts management. The LID also depends on exchange of repairable components.

The LID DISCOM is depicted in figure 2-13. The LID maintenance battalion [Figure 2-14] consists of the headquarters and main support company and three forward support maintenance companies. Each forward company is designed to operate as part of the forward area support team.

Like all other divisions, the LID relies on reinforcing support from nondivisiona! maintenance units to overcome shortfalls in maintenance capability. However the austerity of maintenance assets in the LID requires greater reliance on nondivisional support than other units.

To handle the workload, two maintenance teams are specifically designed to provide support to a LID. The nondivisional LID support team [43-509LP] is assigned to the supporting nondivisional maintenance company, and may be attached to the LID main support company. A nondivisional missle maintenance support team is also required to reinforce LID.

2-25. AIRCRAFT MAINTENANCE

Divisional aircraft maintenance policies, procedures, and units are discussed in FM 1-500.

CHAPTER THREE

TECHNICAL ASSISTANCE AND EXTERNAL SUPPORT

3-1. INTRODUCTION

Technical assistance involves providing advice and assistance. It also provides training on the installation and operation, modification, maintenance, recovery, and evacuation of equipment. This improves operations and conserves resources.

Experience shows that for every man-hour devoted to effective technical assistance, many man-hours of repair are saved at a later date. The maintenance unit may provide technical assistance using its own resources or arrange for additional support from the maintenance assistance and instruction team (MAIT), the formal logistics assistance program, or other maintenance units,

3-2. TECHNICAL ASSISTANCE TEAMS

Organization. A technical assistance team may be composed of one or more individuals, A large team may have an officer in charge, a senior noncommissioned officer, and representatives from various maintenance and supply sections. Personnel assigned to technical assistance teams must have a broad knowledge of both unit and support supply and maintenance operations. They must be tactful and aware of the importance of developing a high degree of cooperation between the using organization and the supporting unit.

Functions. Functions of the technical assistance team include, but are not limited to, the following:

- Advising the supported unit commander in the accomplishment of the responsibilities for unit maintenance and repair parts supply.
- Advising the using unit commander on the efficient use of materiel and on equipment serviceability status.
- Determining the nature and scope of maintenance support required so that a properly manned and equipped MST can be sent for on-site assistance.
- Discussing and resolving mutual problem areas regarding personnel, equipment, or operational procedures and policies.
- Determining what technical instruction and training assistance is needed by unit repair parts supply and maintenance personnel.
- Arranging and scheduling instruction or required technical assistance services to be provided by MSTs.
- Documenting technical assistance requirements for the guidance of subsequently dispatched MSTs.
- Helping the unit commander evaluate condition of equipment and the effectiveness of the maintenance program and formulate required remedial action.

Common Services Provided. Examples of common technical assistance team services include--

- Determining condition of user's equipment by courtesy inspections.

- Scheduling future maintenance support requirements.
- Reviewing the status of outstanding maintenance requests or supply requests.
- Coordinating procedural changes, SOP revisions, repairable exchange lists.
- Interpreting new technical procedures.
- Assisting in establishing an initial PLL or updating an existing PLL.
- Following up on supply requirements to ensure that the units have repair parts and cleaning and preserving materials needed for maintenance.
- Assisting in warranty claim actions.

3-3. MAINTENANCE ASSISTANCE AND INSTRUCTION TEAM PROGRAM (MAIT)

The MAIT program complements the technical assistance described above. It also helps commanders identify and solve materiel readiness problems. The MAIT program is set up at the division level, AR 750-1 provides guidance and direction for conducting the program.

The MAIT visit maybe requested by a unit requiring assistance or by a higher headquarters. When arranging for the team visit, the commander should advise the team chief of known problem areas so that proper team makeup can be determined prior to the visit. The conduct of the visit itself emphasizes "what to do and how to do it" in those areas where improvements arc needed. After the visit, the team chief advises the commander on recommended corrective actions. The MAIT does not score or provide a rating of the unit. Actions required to correct deficient areas, not within the responsibility of the unit commander, are followed up by the MAIT with the units/activities concerned.

The MAIT assistance and instruction include--

- Equipment condition and serviceability.
- Use of tools and test equipment.
- Repair parts supply to include RX.
- Maintenance personnel management and training.
- Records and reports management.
- Publications.
- Facilities/shop layout.
- Quality control procedures.
- New doctrine and techniques.
- Shop operations.
- PM and equipment repair.
- Unit readiness reporting,
- Modification work orders (MWOs).
- Calibration.
- Administrative storage.
- Unit training.
- Safety.
- Unit SOP.

3-4. FORMAL LOGISTICS ASSISTANCE PROGRAM

Technical assistance beyond support unit capability may be provided by United States Army Materiel Command (AMC) military and civilian specialists as well as contract personnel. AR 700-4 provides the details of the formal logistics assistance program. Both military and civilian logistic assistance representatives deploy with the division and can operate as far forward as METT dictates.

3-5. TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE), CALIBRATION AND REPAIR

The Army TMDE support system is based upon the policies and responsibilities in AR 750-25 and the procedures in TB 750-25. The responsibility for general staff supervision of the Armywide TMDE program is assigned to the Deputy Chief of Staff for Logistics, HQDA. The AMC manages, directs, and controls the Armywide TMDE C&RS program.

AMC will maintain the US Army TMDE Support Group (USATSG), Redstone Arsenal, Alabama, to:

- Exercise Armywide technical control of the TMDE support program,
- Exercise command and control of all maintenance battalions (TMDE), maintenance companies (TMDE), and area calibration and repair centers (ACRCS).

3-6. CLASSIFICATIONS OF TMDE

The USATSG, through its subordinate elements, provides single source C&RS for all general purpose TMDE (TMDE-GP) and that special purpose TMDE (TMDE-SP) as designated in TB 43-180. The use of the term "general purpose" TMDE in this manual refers to those items of TMDE that can be used without modification for support operations of more than one end item or system. "Special purpose TMDE" refers to TMDE designed specifically for support on one system or end item. To use TMDE-SP for support of more than one end item or system would require modification to the TMDE. Maintenance of TMDE-SP not identified in TB 43-180 as requiring USATSG support is the mission responsibility of the system dedicated DS maintenance unit.

3-7. TMDE SUPPORT CONCEPTS

TMDE support normally will be based on the concept that repair should be done by the element designated in TB 43-180 as being responsible for calibration support. TMDE support will be as follows:

- All TMDE owners or users will accomplish unit maintenance on organic TMDE.
- Maintenance companies (TMDE) will provide calibration and/or repair support for all TMDE-GP and that TMDE-SP designated in TB 43-180 as requiring USATSG support.
- DS/GS and aviation intermediate maintenance (AVIM) units will provide support service for organic and supported units' TM DE-SP designated in TB 43-180 as requiring DS/GS and AVIM unit calibration and/or repair.

NOTE: *Certain TMDE-SP may require C&RS to be done by both the USA TSG and a DS/GS or A VIM unit on a coordinated basis. For example, a large TMDE-SP console may include some TMDE-GP which would normally be serviced by an area TMDE support team (ATST). The remain - ing components of the console are TMDE-SP and require specialized training to accomplish repair. In this case, the ATST and DS/GS or AVIM unit personnel will work together to accomplish the required C&RS.*

3-8. DIVISIONAL TMDE SUPPORT

The maintenance company (TMDE) emphasizes responsive C&RS to supported units. This support is provided primarily by ATSTs, with contribution from the area calibration laboratory (ACL). All ATSTs of a company are considered to be mobile because they have organic transportation. ATSTs are assigned a mission of dedicated divisional support or geographical area support. An example of dedicated divisional support is the attachment of an ATST to a divisional CSS battalion. This ATST would provide C&RS to all divisional units and, where circumstances warrant, to those nondivisional units operating within the division area. A geographical area support mission can be illustrated by the attachment of an ATST to an area support group. The ATST would provide support to all divisional and nondivisional units within or passing through the assigned geographical area.

The ATSTs are mobile and air transportable (when required) to support unit sites. Each team is equipped with necessary tools, one set of secondary transfer standards, a TMDE repair set, repair parts, and expandable vans to transport equipment. The 5-ton vans, when expanded, provide a suitable work area for TMDE C&RS.

ATSTs may perform TMDE support at direct maintenance unit locations. These units are normally provided 30-days advance notice of scheduled ATST visits. The TMDE located at using units requiring support is transported to its maintenance unit. When established schedules conflict with using unit operational requirements, the unit may be rescheduled. Under exceptional circumstances the ATST may perform C&RS at the using unit if it is deemed impractical by the ATST chief to bring certain items requiring service to the ATST.

The structure of an ATST does not allow for operations as an autonomous unit. It is totally de-

pendent upon the unit of attachment for messing support and, to a lesser extent, for communication and POL support and maintenance of organic vehicles. Its defensive capability is limited to small arms. The host unit is responsible for providing the support required by the ATST and integrating it into the defensive plans.

3-9. TMDE SUPPORT COORDINATOR

All using unit commanders are responsible for management of their TMDE and play an active role in the TMDE C&RS program. A commander's actions influence the quality of TMDE support the unit receives and the ability of the TMDE to support mission requirements. A key figure in a commander's TMDE support program is the TMDE support coordinator,

Each divisional unit that uses TMDE will designate (in writing) a TMDE support coordinator. The coordinator will be the central point of contact for TMDE calibration and repair matters concerning the unit's organic TMDE. The coordinator will be responsible for and have authority to monitor the divisional units' C&RS program. That program will be consistent with AR 750-25, AR 750-43, and TB 750-25.

ATSTS work with the supported unit's TMDE support coordinator to maintain accuracy of the automated data base and automated printouts. Recall listings from the supporting ATST tell the using unit when specific items should be presented for calibration. Delinquency listings are also provided which reflect the items that should have been presented for calibration, but were not.

Calibration scheduling is an important aspect of using unit TMDE management. TMDE that has not been calibrated by the calibration due date shown on the DA Label 80, Calibrated Instrument Label, cannot be used until it is calibrated. This may greatly affect unit readiness if the number of individual items of TMDE is low. Batching of TMDE has a similar effect on readiness.

To avoid these adverse effects, the TMDE support coordinator should spread out the calibration schedule for a particular type of item over a period of time. Calibration intervals may be reduced when required to improve scheduling. The coordinator should be alert to special needs for major field exercises and other critical periods when the unit must be at peak readiness.

3-10. USING UNIT PROCEDURES

The unit TMDE support program is based on the TMDE on hand in the unit. Property records and hand receipts indicate what should be in the unit.

DA Form 2416, Calibration Data Card, is used to enter individual TMDE items into the program. The card is prepared according to TB 750-25. It identifies the item by nomenclature and serial number and states whether or not calibration is required. Calibration and repair requirements are contained in TB 43-180, If calibration requirements for an item cannot be found, DA Form 3758, Calibration and Repair Requirements Worksheet, is completed according to TB 750-25 and is used to enter the item into the program.

Unit maintenance of TMDE is a using unit responsibility. The MAC for the equipment states what maintenance is to be performed. This is limited to cleaning, servicing, and minor repairs, such as replacement of fuses, lamps, knobs, filters, screws, and so forth.

The ATST's external SOP must be followed when presenting TMDE for calibration ***or*** repair. In some instances, the TMDE must be accompanied by adapters, cables, accessory items, and technical or manufacturer's manuals. DA Form 2402, Exchange Tag, is completed and attached to each item presented for calibration. The using unit retains a copy of this form as a receipt and exchanges this receipt when service has been completed. For repair, DA Form 2407/5504, Maintenance Request, is used. The receipt copy is retained by the using unit until the TMDE is returned.

When a using unit moves to a new support area, TMDE support is shifted to a different ATST. The using unit is responsible for coordinating the shift in support requirements with the losing and gaining support organization.

Using units must ensure that TMDE is picked up promptly when services have been completed.

3-11. DMMC PROCEDURES

The materiel section of the DMMC (MATO in the LID) provides central management of the division's TMDE calibration and repair program. This section:

. Assists unit TMDE support coordinators in identifying materiel which requires calibration or repair.

- Schedules C&RS in coordination with the supporting ATST or DS/GS/AVIM units.

3-12. DS/GS/AVIM UNIT PROCEDURES

TMDE support procedures for organic TMDE of DS/GS/AVIM units are the same as those outlined for using units. However, these units provide their customers C&RS for selected items of TMDE-SP.

TB 43-180 determines if an item of TMDE-SP is supported by the DS/GS/AVIM maintenance unit or the ATST.

The DS/AVIM unit provides customers the same type of support for TMDE-SP within their responsibility as the ATST. This includes establishing and maintaining an instrument master reference file (IMRF), providing supported units with a recall schedule, providing C&RS, and informing supported units of delinquent TMDE-SP.

3-13. ARMY OIL ANALYSIS PROGRAM (AOAP)

The AOAP is part of a DOD peacetime program designed to analyze equipment lubricant condition and to detect impending component failure through periodic evaluation of oil samples, Oil analysis provides a diagnostic tool which determines the internal condition of engines, gearboxes, transmission, and other oil-lubricating systems and components. It also permits on condition oil change (OCOC) where applicable. Using the OCOC technique, oil is changed on the basis of oil quality rather than a fixed time or mileage interval. AOAP operations will be suspended in combat operations,

3-14. PROCEDURES

Sampling Requirements. The AOAP requires periodic sampling. The sampling frequency varies with equipment, For example, combat vehicles are sampled after every 25 hours of operation or 30 days, whichever occurs first. Tactical wheel vehicles are sampled every 100 hours or 60 days. To determine sampling requirements for specific items, consult DA Pamphlet 738-750 for nonaeronautical equipment and TB 43-0106 for aeronautical equipment.

Special Samples. Special samples are taken by unit maintenance personnel as outlined in DA Pam 738-750 and TB 43-0106.

Sampling Supplies, Forms, and Records. DA Pam 738-750 and TB 43-0106 lists the supplies required for the AOAP oil sampling operations. The AOAP uses the following forms and records:

- DA Form 2407/5504, Maintenance Request.
- DA Form 2408-20, Oil Analysis Log (replaced by ADP printouts if the laboratory is automated).
- DA Form 3254-R, Oil Analysis Recommendation and Feedback.
- DD Form 314, Preventive Maintenance Schedule and Record.
- DD Form 2026, Oil Analysis Request.

Laboratory Analysis. The functions of the oil analysis laboratory are described in DA Pam 738-750, TM 38-301, and TB 43-0106. The Army has 24 AOAP laboratories used for routine oil analysis, and 5 depot laboratories used for quality assurance testing of reconditioned materiel. Eighteen of the 24 are located in CONUS and the remaining 6 are in OCONUS. In accordance with Joint Oil Analysis Program (JOAP) requirements, Army equipment is also supported by the Navy and Air Force oil analysis laboratories. The Navy laboratory at Pearl Harbor, Hawaii, provides support to U.S. Army Western Command, Hawaii. Korean National personnel, employed by the U.S. Army, analyze samples from Army aircraft at the Air Force laboratory at Osan Air Base, Korea. Laboratory support for the U.S. Army South, Panama, and units deployed in Central America is provided by Army civilian personnel utilizing the JOAP laboratory at Howard Air Force Base, Panama.

Field Feedback. When maintenance action is indicated by the analysis, it is essential to provide feedback information to the laboratory. This refines procedures, increases prediction accuracy, and recommends design changes to items showing a high failure rate. The DA Form 2408-20, or ADP printout, must accompany the unserviceable component from the DS unit to the GS or deport turn-in point.

DA Form 3254-R is used by the laboratory to provide specific recommendations. This same form is used by the unit to provide feedback to the laboratory.

When direct support level maintenance is part of the recommendation, the unit submits the equipment to support maintenance and encloses a copy of DA Form 2407/5504 with the DA Form 3254-R enclosed.

3-15. WARRANTY CLAIMS

When it is in the Army's best interest, certain items are acquired with a warranty from the manufacturer. The warranty is normally applicable for a specific period of time or mileage. It protects the government against design deficiencies or poor workmanship during the period it is in effect. When the end item, component, part, or assembly covered by the warranty fails, a warranty claim must be initiated to recover the costs involved.

3-16. THE ARMY WARRANTY PROGRAM

The decision to acquire or apply a warranty is made on a case-by-case basis during the acquisition process. A warranty decal is used to identify items covered by warranty. Information concerning the warranty and warranty use, data submission, and warranty assistance is included in material fielding plans, technical bulletins, or other media. The acquiring command is responsible for developing procedures to put the warranty into effect, The major command assigned the item for use is responsible for implementing the prescribed procedures. DS maintenance units provide the points of contact for executing the established procedures.

Details of the Army warranty program are found in AR 700-139. Warranty claims are submitted using DA Form 2407/5504 (DA Pam 738-750). Warranty actions will be suspended during combat operations.

3-17. WARRANTY APPLICATION

Warranty actions are reported IAW DA Pam 738-750, implementing instructions, and AR 700-139. Unit readiness and mission effectiveness take priority in case of conflict with warranty application. If the support activity cannot get an effective response through the warranty process, they should fix first and settle later, using bill back procedures when available.

3-18. WARRANTY CLAIMS ACTION

When components, parts, or assemblies of end items are identified as being defective and are covered by a manufacturer's warranty, a warranty claim action is initiated to obtain reimbursement for maintenance man-hours required to replace the defective items. Claim action may be initiated at all levels of maintenance.

Support maintenance activities are the responsible points of contact between the originator of warranty claim actions and the national inventory control point (NICP) serving as the DA representative with the contractor. All warranty actions, settled or unsettled, are reported to the national level.

When it has been determined that a component, part, or assembly of an end item under warranty is defective because of design deficiency or poor workmanship, the defective component, part, or assembly is identified as a warranty claims exhibit. DA Form 2402 is used to tag all exhibits. Instructions for completion of this form are contained in DA Pam 738-750.

DA Form 2407/5504 is used to submit the warranty claim. The form is filled out according to DA Pam 738-750. The remarks block is used to provide details concerning the cause of the failure, identification of the end item, and the applicable warranty.

A receipt copy of the DA Form 2407/5504 authorizes immediate replacement action through supply channels by the claim originator.

Support maintenance activities are responsible for prompt handling of all warranty claim actions. This includes processing approved claim actions back to the originator and the processing of funds reimbursed for cost of labor required to replace the defective components, parts, or assemblies.

3-19. MODIFICATION WORK ORDERS

MWOs are DA publications which provide authority and instructions for the modification of Army materiel. MWOs are identified in DA Pam 750-10. Equipment may be modified to:

- Increase safety of personnel.
- Prevent damage to equipment.
- Increase combat and operating effectiveness.
- Improve equipment compatibility.
- Improve and simplify maintenance.

Types of MWOs. MWOs may include conversion, field fix, retrofit, remanufacture, or engineering change. They are further classified by an urgency code which describes the effect on the end item and the time frame for application of the MWO. The classification, effect on equipment, and time frames are shown in Table 3-1

MWO Control and Application. Responsibility for application of MWOs is with equipment sponsoring agencies at DA level. These agencies maintain data on MWO requirements and develop and execute plans for MWO application. They verify the national level MWO data base annually by reconciling listings with user commands. Information on application of MWOs is provided by MWO advance information support list allowance card (SLAC) decks, The actual application of MWOs is negotiated with the user major Army command (MACOM). This results in a memorandum of understanding (MOU) which gives the details for the MWO application. The MOU specifies any DS/GS unit application responsibilities for the MWO. A point of contact for each MOU is assigned at MACOM level. Further details regarding the DA MWO program are in AR 70-15.

3-20. DIVISION MWO OPERATIONS

The DMMC maintains and operates the division MWO operations and is responsible for MWO accounting procedures, maintaining the status of all MWOS for equipment, and directing the order of completion for MWOs.

Table 3-1. MWO classifications.

CLASSIFICATION	EFFECT ON EQUIPMENT	TIME TO APPLY
URGENT	DEADLINES	IMMEDIATELY
LIMITED URGENT	LIMITED OPERATION	120 DAYS
NORMAL	NONE	12 MONTHS

CHAPTER FOUR

SUPPORT VARIATIONS BASED ON TACTICAL SITUATION

SECTION 1. INTRODUCTION

4-1. MAINTENANCE UNITS

DS maintenance units, as part of the division, must maneuver and deploy to provide maintenance service support, Maintenance support operations are influenced by deployment of the division, its organization for combat, the tempo and type of combat operation, and availability of suitable terrain.

In some combat situations, maintenance units are deployed well forward; in other situations, they are deployed to the rear. In some cases, maintenance units accompany or closely follow supported units; in others, maintenance units remain behind until ordered to move forward. In still other situations, the bulk of the maintenance units may displace before supported units do.

The type and tempo of combat also affect the nature of the work load of the DISCOM maintenance units. During fast-moving offensive operations, the maintenance shop work load may be light with maintenance efforts primarily geared toward mobility systems. When the advance slows or the pursuit phase ends, however, maintenance units have to increase their activities with maintenance efforts focused on armament systems. During the offensive phase, priority of effort may be directed to recovery and evacuation and roadside-type repair, or to collection, classification, and reporting of abandoned equipment.

4-2. MAINTENANCE SUPPORT OF OFFENSIVE OPERATIONS

The maintenance unit commander prepares for support of offensive operations much the same as the maneuver unit commander. The combat situation is appraised, the support needed is determined, and then resources are organized to provide the support.

4-3. COMMAND, CONTROL, AND COMMUNICATIONS

Offensive operations are characterized by fast movement and rapid changes in the situation. Command, control, and communications of the CSS effort is difficult. Maintenance elements normally operate in the proximity of other CSS elements which reduces some of the difficulties.

The DJSCOM or maneuver brigades provide information to the division headquarters on the locations of support elements operating in forward areas. Under conditions of rapid movement and displacement, it will not be possible to provide specific information on the proposed locations of units in sufficient time for inclusion in division orders.

In a fast-moving situation, the DISCOM may be able to keep the division operations center informed only of its command post (CP) location.

This information is contained in administrative orders, on operation's overlays, or may be disseminated through fragmentary orders. With this minimal information, units must locate the DISCOM or

brigade CP to obtain precise locations of support units. The DISCOM continues to provide follow-up reports or situation overlays to support the daily operations report of the division.

In extremely fast-moving situations, units of the DISCOM operating in forward areas may move before advising the DISCOM headquarters. These units coordinate their movements and locations with the major supported headquarters (normally brigade). Because of distances involved and communications limitations, it may not be possible for these units to effect timely notification of parent units in the DSA. However, since major headquarters report all new locations to the division operations center, the DISCOM headquarters will learn of new locations of brigade trains areas from the division TOC.

Each DISCOM unit has the responsibility for notifying its parent headquarters of the opening and closing of its CP and for providing advance information of planned moves. Such advance information is essential for providing support forward.

4-4. SUPPORT PROCEDURES FOR OFFENSIVE GROUND OPERATIONS

Prior to initiation of offensive operations, equipment of participating units is inspected by the unit and required maintenance is performed. Equipment shortages are made up, repair parts stockage is brought up to desired levels, and reserve stocks of critical items are set up. Operations and administrative orders are prepared and disseminated. Priorities are set up for support, to include priorities for issue of float stocks and critical repair parts. Procedures, priorities, and conditions for serial resupply are set up. At higher levels, plans, orders, and mission assignments are broad in scope. At successively lower echelons, plans are more complete and detailed.

Maintenance planning, prior to the offensive, considers task assignments of--

- Support units.
- Stock levels for repair parts.
- Maintenance time guidelines.
- Forward displacement of MST/MCP.
- Channels and procedures for recovery, collection, evacuation, and disposition of captured or abandoned materiel.

Repair parts stockage is kept consistent with the mobility requirements. Based on the type of operation, the geographical area, and terrain and weather conditions, certain items in the supply stockage are increased. For example, extensive operations over rough terrain would dictate build up of stockages of vehicle springs, shock absorbers, and tires. Forward deployed MSTS increase stockage of small high usage RX items, such as fire control instruments and automotive subassemblies.

As the tempo of the situation and the distance involved increase, support units may have difficulty keeping pace with requirements. Maintenance support is displaced as far forward as practical. This, however, must be done in light of MST vulnerability, the capability of the enemy to launch a successful counterattack, and the requirements for maneuver room and road space by combat elements. In operations where the overall situation requires bypassing pockets of the enemy or guerilla elements, the effects of such bypassing on support units and other logistical activities must be considered. In some situations, assistance from combat elements may be required to provide security to logistical operations.

The CSS commanders and staff officers must plan for the redirection of logistical support to satisfy changing tactical requirements. Redirection of effort and supplies, redeployment of units, realignment of the support structure, and changes in support procedures and emphasis, are matters that take time and require close coordination and planning. Continuous movement limits the length of time in which repairs can be performed. Shorter maintenance time guidelines for rearward MCP should be set.

If the offensive is successful and gains momentum, a culminating point maybe reached where logistical support limitations make the entire force vulnerable. Lacking the ability to maneuver and displace as rapidly as combat forces, CSS forces maybe outdistanced by the combat units. Resupply of repair parts by unit distribution may break down or become ineffective due to lack of transportation, difficulty in locating units, and increased order and ship time.

The force commander must be informed of the effect of the tactical situation on the capability of the support structure to provide required support. Expedients to provide maintenance support under these circumstances include--

- Instituting BDAR.

- Setting up procedures and controls which allow MSTs to draw from bench stock, ASL, or RX those items anticipated to be needed for on-site repairs and high usage items.

- Increases emphasis on evacuation of unserviceable equipment, with repair operations in forward areas limited to component replacement, adjustments, and servicing.

- Round-the-clock operations of supporting units to the limits of physical endurance.

- Use of air transportation to move MSTS and repair parts.

DISCOM maintenance units must maximize repair efforts forward. Unserviceable equipment requiring more than limited component replacements, adjustments, and servicing should be evacuated to a centrally located MCP. The centralized MCP maximizes BDAR, WSRO and cannibalization, and controlled exchange operations. Unserviceable equipment requiring extended repairs are consolidated and turned over to follow-on maintenance elements. Figure 4-1 illustrates various maintenance activities and the flow of maintenance elements in the forward area in support of offensive operations.

4-5. DEFENSIVE OPERATIONS

Types of defensive operations include the defense, delay defense of an encircled force, and rear operations. Activities associated with defensive operations include counterattacks, passage of lines, withdrawals, and reliefs to continue the defense.

Large defending formations, such as the division, may have portions of their forces conducting any of

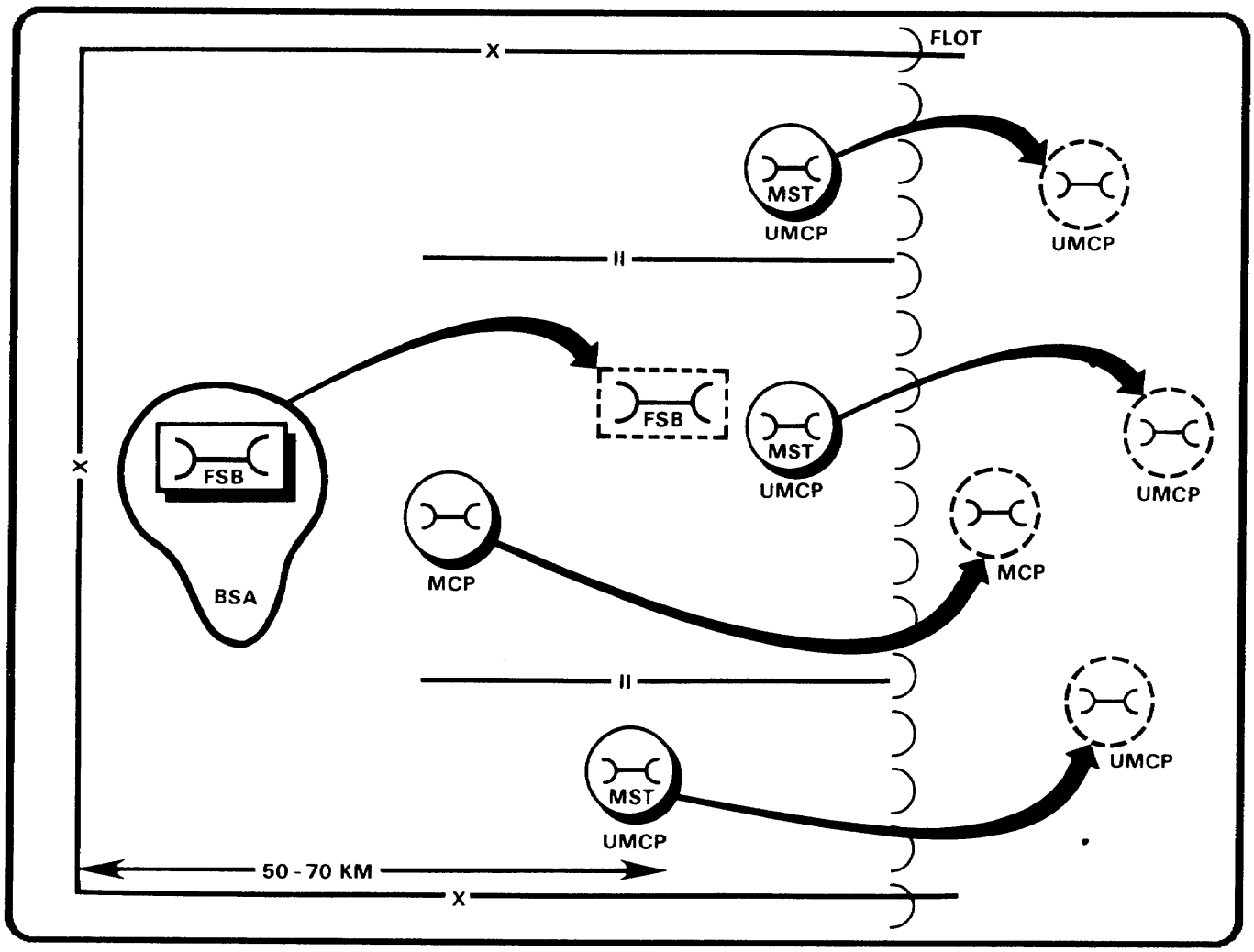

Figure 4-1. Flow of maintenance activities.

these operations or activities simultaneously. Defense may be static or dynamic. It takes a coordinated effort to defeat the attackers and prevent them from achieving their objectives.

The MSTs deployed with maneuver units are task organized to maximize on-site repair capacity. The team may relocate several times a day, keeping pace with supported units. Maneuver unit maintenance elements must assess unserviceable equipment for on-site maintenance or movement to the nearest UMCP.

Initial BDA is made on site and a plan is formulated for each unserviceable item. Follow-on maintenance elements are notified of maintenance requirements beyond the set time guidelines or capacity of the MCP elements to allow follow-on maintenance elements to plan their maintenance efforts, Maintenance support must be echeloned in depth. The base company and forward MCP must leap-frog forward so that continuous support maybe maintained.

4-6. MAINTENANCE SUPPORT OF DEFENSIVE OPERATIONS

Maintenance support for defensive operations must be planned, organized, and executed with the same attention to supported unit requirements as for offensive operations.

4-7. DURING DEFENSIVE OPERATIONS

Supported units are not as widespread as in the offense. Maintenance support operations can, therefore, be more centralized. Defensive operations also do not require displacement as often as in the offense, so command, control, and communications are simplified. The exception to this is support of retrograde operations, such as delay or withdrawal. The need for continued support while engaged in a unit move makes this a difficult operation to support.

4-8. SUPPORT PROCEDURES FOR DEFENSIVE OPERATIONS

In a static defense, the defending force remains in position for longer periods. Movement and maneuver of the defending force are considerably reduced in comparison to a dynamic defense or an offensive operation. In a static defense, support units do not have to deploy as often as in other types of operations. More time is available for maintenance operations. Maintenance facilities can operate better, since they do not have to react so often to changing situations and requirements.

Repair parts stockage is generally increased and reserves of critical items are built up. Care should be exercised in selecting only needed items so that mobility is not impaired. Equipment inspections and technical assistance are emphasized to maintain readiness at a high level.

A dynamic defense requires maneuver and movement on the part of elements of the defending force. Maintenance units may also expect to move more frequently than during an area defense. In the dynamic defense, vehicular maintenance requirements are greater than in static defense, particularly with respect to track vehicles. This will result in increased evacuation from the forward support elements to maintenance elements farther to the rear.

If the defensive situation becomes critical, unit and support maintenance personnel may have to cease operations and participate in the defense of their unit.

Detailed planning, control, and coordination are required for support of delaying or withdrawal operations. Emphasis must be given to evacuation of unserviceable equipment that cannot be repaired before opposing forces overtake the position. Displacement of the support elements must not conflict with movement of the combat units, When possible, maintenance support units should be displaced at night.

Maintenance is concentrated on those weapon systems and materials directly required to support the retrograde operation. Priority of support should be given to units that have completed the movement to the next location and are preparing a new position. Emphasis must be placed on items that can be repaired most readily. Other equipment should be evacuated directly to future planned support areas. Extensively damaged equipment should be used for controlled exchange or cannibalization.

Maintenance plans must be closely coordinated with the tactical plan so that maximum support can be provided without interfering with operations of the combat elements.

Recovery equipment is critical to the support of retrograde operations. Its use must be rigidly controlled and coordinated, Recovery equipment should be marshaled at critical locations to keep routes open and recover all materiel possible.

Badly damaged equipment should be evacuated or destroyed. Specific instructions must be provided for the destruction of supplies and equipment.

SECTION Il. NBC CONSIDERATIONS (IMPACT ON MAINTENANCE)

4-9. SUPPORT CONCEPT

Maintenance personnel must provide maintenance support on the integrated battlefield. Individual soldiers must be trained to survive an initial nuclear or chemical attack and to continue the mission in a toxic environment under conditions of great mental and physical stress.

MAINTENANCE ACTIVITIES, WHEN POSSIBLE, SHOULD OCCUPY PROTECTED AREAS SUCH AS UNDERGROUND GARAGES OR CONCRETE BUILDINGS.

Maintenance activities, when possible, should occupy protected areas such as underground garages or concrete buildings. Such areas provide some cover from liquid chemical agents and shielding from radioactive contamination. Units should establish SOPS for contaminated vehicle and equipment maintenance procedures delineating--

- Inspection and contaminated MCP procedures.
- Procedures for requesting emergency equipment decontamination.
- Responsibilities and procedures for establishing and operating a contaminated equipment holding area.

4-10. CONTAMINATION PROBLEMS

Petroleum products tend to trap chemical contaminants. A vehicle quite safe for an operator to use without MOPP 4 protection may be unsafe for a mechanic to repair. Chemical contamination is likely to collect in bolt threads, hydraulic fluids, and closed assemblies. When mechanics open air filters, for example, they might be exposed to lethal concentrations of hazardous vapors. Therefore, all repairs and PM to previously contaminated vehicles must be done in a protected posture. Oil, grease, and dirt seriously degrade the protective qualities of the chemical overgarment.

Mechanics must keep themselves as clean as possible. Extra overgarments should be on hand to replace dirty ones. Wet weather gear helps keep overgarments clean but vastly increases heat buildup and will eventually be penetrated. The combination of protective gear and wet weather gear provides good, although extremely hot, protection from a combination of toxic chemicals, grease, and oil contamination. Fuel handlers aprons and field ex-

pedient rubber sleeves can provide added protection with much heat stress.

4-11. PRINCIPLES FOR CONTAMINATION CONTROL

Maintenance teams should make every effort to repair contaminated equipment in a contaminated MCP. Return repaired but contaminated equipment to units that are contaminated, whenever possible. Even if equipment has gone through unit restoration decontamination, it can still be hazardous to handle. A previously contaminated unit will already be conducting periodic contamination checks and will be able to use the equipment safely because of the precautions they are already taking. Contaminated equipment and tools must be stored at a location downwind of clean areas. Every effort must be made to control the spread of contamination. Contaminated vehicles and equipment should not be evacuated for repairs. If DS maintenance is required, an MST will be sent forward to effect repairs in the contaminated MCP. DS maintenance units should treat all customer equipment as though it were contaminated until inspected. Figure 4-2. illustrates a contamination maintenance support operations layout.

4-12. PROVIDE PROTECTION FROM CONTAMINATED EQUIPMENT

Even though decontamination is done, maintenance teams cannot be sure that a vapor hazard trapped by oils or held inside a closed assembly will not appear at some point during the maintenance process. To guarantee safety, the maintenance officer must decide what MOPP level mechanics should use.

Operate chemical agent detection equipment while contaminated equipment is being repaired. The testing must be a continuous process. Vapor hazards may not be present in open terrain, but as soon as the vehicle is moved into an area where air does not circulate, significant vapor hazards may concentrate. If contamination is ever detected after an assembly is opened, the assembly can be decontaminated hastily by flushing with diesel or motor gasoline (MOGAS). The unserviceable component must then be marked and taken to the contaminated holding area, where it can weather or undergo more thorough decontamination.

For reparable assemblies, wait until the assembly no longer gives off vapor. The fuel used for this

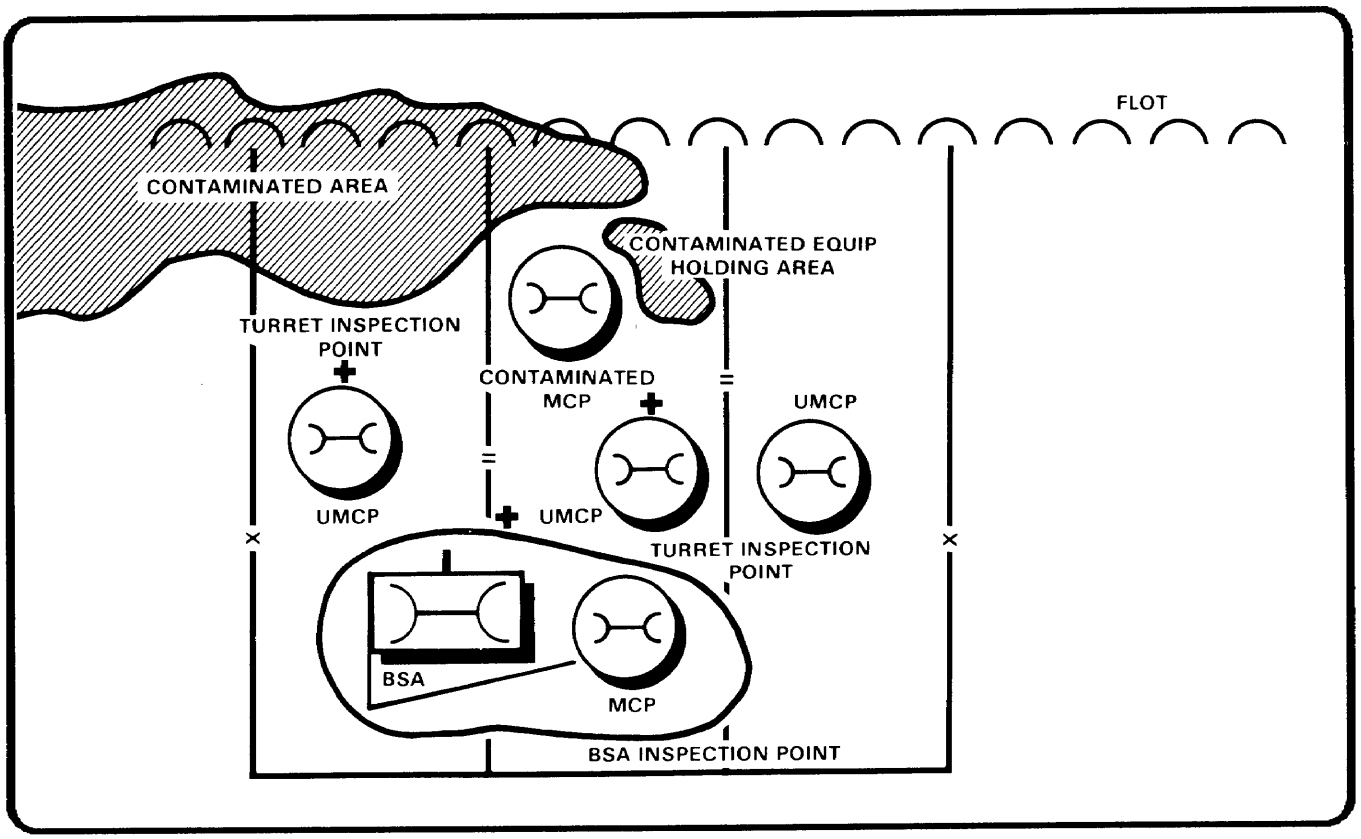

Figure 4-2. Contaminated maintenance support operations.

flushing must also be marked contaminated and dumped in the contaminated sumps at the decontamination site or disposed of per unit SOP.

Maintenance personnel repairing equipment with radiological contamination should wear a dosimeter and be closely monitored for level of radiation exposure. They must avoid exceeding exposure levels, When the highest acceptable levels are reached, personnel should be replaced, mission permitting. The amount of radiological contamination they can tolerate will vary depending on operational exposure guidance (OEG) and the tactical situation. Priorities for monitoring equipment should go first to the recovery teams, inspection point MSTs, and then the MCP.

4-13. MARK VEHICLES AND EQUIPMENT TO PROTECT OTHERS

Contaminated vehicles must be identified with a standard triangular contamination sign in the vicinity of the driver's compartment. The type and date of contamination should be written on the sign. The sign should be easily visible from the outside of the vehicle and may not be removed for nonpersistent agents until decontamination has been verified by a detailed inspection. Contamination signs on vehicles and equipment contaminated with persistent agents will not be removed even after decontamination. Nonvehicular equipment should be similarly marked in a conspicuous location,

4-14. SUPPORTING CONTAMINATED EQUIPMENT FROM A CLEAN AREA

The strategy for supporting from an uncontaminated area is to prevent contaminated equipment and personnel from entering a clean area. Work within a clean area can thus be done at reduced MOPP and with greater efficiency. once NBC attacks have occurred within the area of support, the unit must assume that all the equipment it supports is contaminated. To deal with this, the maintenance unit must set up separate inspection and MCPs. All vehicles, personnel, and supplies must pass through this inspection point before they enter the maintenance area,

The inspection team must segregate the equipment. Uncontaminated equipment can go straight to the maintenance area. Contaminated vehicles and equipment must be marked with standard triangular contamination signs, then a decision must be made on the disposition of the equipment, If contaminated with a nonpersistent agent and repairs cannot be performed in MOPP 4, the item may be sent through decontamination or left to weather.

Before any repairs are made, the equipment should go through unit restoration decontamination. Priority equipment must be decontaminated first. If contaminated with a persistent agent, every effort should be made to replace the contaminated component with the next higher assembly that can be done in MOPP 4. Contaminated equipment or components should be marked with a triangular contamination sign and placed in the holding area to await disposition instructions from higher headquarters.

Once equipment and tools have been used for contaminated maintenance, they should be left contaminated. Use rags to wipe off only the gross contamination. Dispose of the rags by soaking in decontaminant solution and holding, or bury them and mark the location. Maintenance teams may go through a MOPP gear exchange or detailed troop decontamination. The teams' equipment and tools should be left alone. A fresh team can use the contaminated tools on other contaminated equipment. For extended repairs, a fresh team can relieve contaminated teams who move back and undergo detailed decontamination. After a rest, the newly decontaminated team rotates forward and relieves the contaminated team.

4-15. SUPPORT FROM A CONTAMINATED AREA

The physical and emotional limits on the length of time personnel can operate in MOPP 4 severely restrict the maintenance support which can be provided from contaminated area, It may be possible to extend the length of time the unit can ***con***tinue to support from the contaminated location by scheduling periodic withdrawal of personnel to a clean area for complete personnel decontamination and a rest period at a reduced MOPP level. For continued effectiveness, however, the unit must depart the area, go through a complete equipment and decontamination process, and set up shop in a clean area. The time limitations may dictate that only the most critical repairs continue, while the remainder of the unit moves to a clean area. The limited organic transportation capability may require that some unit and customer equipment be left in place. Following

setup at the clean area, this equipment may be recovered or repaired.

4-16. CONTAMINATION AVOIDANCE

The severe impact of contamination on the unit's mission capability dictates that avoiding contamination may be the keystone of the maintenance unit's strategy for support in an NBC environment. This makes it essential that the unit NBC defense personnel monitor the NBC situation by maintaining contact with higher headquarters and their counterparts in supported units. Prior to dispatch to MSTs, as much information as possible must be obtained relating to the threat along the route of march and at the support location. The location and availability of division decontamination equipment must be carefully monitored.

SECTION Ill. NIGHT OPERATIONS

4-17. TRAINING

The goal of night maintenance operations is to attain the same degree of effectiveness as in daylight operations and to sustain the effort over long periods of time. Intensive night training is the key in attaining this goal. Those tasks which cannot be performed under subdued visible light or night vision goggles are identified. Procedures are developed for deferring them until daylight hours. Procedures are developed for the pre-positioning of equipment, tools, and repair parts supplies. This allow ready access, identification, and handling during the night. Criteria are established for site selection which specifically address the effective use of terrain, natural cover, and concealment to avoid direct enemy observation. Procedures for night movement and relocation stress light discipline and camouflage.

4-18. THE IMPACT OF SECURITY REQUIREMENTS ON MAINTENANCE MANPOWER

The planner must remember that maintenance elements will be providing 24-hour maintenance support, plus security, and plan accordingly. Planners should expect a degradation in support as 24-hour operations are sustained.

4-19. THE IMPACT OF CAMOUFLAGE AND SITE SELECTION

Maintenance support sites, while meeting all the other doctrinal criteria, must also be selected because they can be camouflaged effectively to avoid direct enemy observation. The enemy has night devices such as image intensifiers (starlight scopes), infrared devices (binoculars and rnetascopes), thermal imaging devices which see the heat given off by a warm or hot object, and various types of battlefield illumination. Maintenance elements will be continuously dealing with equipment which provides observable signatures. Planners and operators must be aware of the effects of enemy observation of these signatures. With the sophistication of weapons and target acquisition means over the past years, detection of a target has become almost equivalent to its destruction. This fact points out the need for careful planning of maintenance support locations.

SECTION IV. OPERATIONS SECURITY

4-20. OPSEC PHASES

OPSEC is the action taken to prevent the enemy from obtaining information relating to friendly operations. Throughout the planning, preparation, and execution phases of maintenance operations, every effort must be made to maintain security.

4-21. OPSEC PLANNING

OPSEC planning by maintenance units maybe organized into the following sequence:

- Determine enemy capabilities for obtaining information about maintenance operations.
- Determine what information obtained by the enemy can compromise friendly operations.
- Determine what actions taken by the maintenance unit before an operation would provide the enemy with needed information.
- Determine what protective measures are necessary and where they must be implemented to maximize OPSEC.

4-22. COUNTERSURVEILLANCE

This includes all active or passive measures taken to prevent the enemy from seeing the friendly area, equipment, movements, and so forth. Some OPSEC techniques include making maximum use of terrain for concealment, moving at night or during periods of reduced visibility, using camouflage, and maintaining noise and light discipline.

4-23. TRANSMISSION SECURITY

This involves use of CE security techniques to prevent the disclosure of operation information. Some practical techniques for maintenance units to employ are to keep radio transmission short, maintain signal silence, use wire communications whenever possible, and use the low power setting on radios. Transmission security information may be found in field SOPS, security instructions, and in the unit's current CEOI.

4-24. PHYSICAL SECURITY

This consists of the use of security forces, barriers, dispersal, concealment, and camouflage in order to deny the enemy access to facilities, areas, equipment, materiel, and personnel to protect operational information or activities. Some practical techniques to apply include--

- Using security elements to the front, rear, and when required, flanks on convoys.
- Using listening and observation posts in garrison or bivouac areas.
- Identifying likely avenues of approach and covering them with fields of fire.
- Employing obstacles to impede the enemy.
- Using challenge and passwords.
- Using early warning devices.

4-25. INFORMATION SECURITY

This is the control of written, verbal, and graphic information to prevent the disclosure of operation information, OPSEC measures include never posting information in the open, such as on vehicle windshields; not allowing local civilians into work and assembly areas; and proper handling of all classified and sensitive information,

INFORMATION SECURITY IS THE CONTROL OF WRITTEN, VERBAL, AND GRAPHIC INFORMATION TO PREVENT THE DISCLOSURE OF OPERATION SECURITY.

SECTION V. RECONSTITUTION PROCESS

4-26. RECONSTITUTION

Reconstitution is the total process of providing replacement of critical supplies, services, personnel, and equipment to restore the combat effectiveness of

a unit. It encompasses unit regeneration and sustaining support.

4-27. UNIT REGENERATION

Unit regeneration consists of those replacement, reorganization, and redistribution actions needed to restore the ineffective unit to the desired level of readiness.

4-28. SUSTAINING SUPPORT

Sustaining support includes those actions that are constantly in progress to maintain a unit at a desired level of combat effectiveness.

Included is replenishment of all classes of supply and the transportation needed to accomplish replenishment, essential maintenance, recovery and evacuation of inoperable equipment, medical treatment and evacuation, individual personnel replacement, and services required to sustain the unit.

4-29. RECONSTITUTION OPERATIONS

Reconstitution is done as far forward as possible so that units may be returned to combat with minimum delay, This is normally in the support area two levels higher than the unit being reconstituted. Maintenance support of reconstitution operations initially consists of assessing the damage and then shifts to repairing as many weapon systems as possible in response to the priorities set by the commander.

BDA is used to appraise major weapon systems status. This effort shows the number of items destroyed or damaged beyond repair in the forward area and the number that can be repaired forward. **It** also shows the location of forward maintenance and salvage collecting points and transportation required to support recovery and/or evacuation. Repairs concentrate on mission essential maintenance only and the priorities established by senior commanders.

CHAPTER FIVE

RECOVERY AND EVACUATION

5-1. SUPPORT

When equipment cannot be repaired on site, it must be brought to the maintenance activity best suited to do the repairs. This is done by recovery and evacuation.

Using units recover equipment to their supporting maintenance activity. The maintenance activity either repairs the item or evacuates it to another activity for repair. When transportation requirements exceed the maintenance unit capability, the unit requests transportation support from the Transportation Motor Transport Company, MSB, through the DISCOM movements officer of the Security, Plans, and Operations Office.

5-2. RECOVERY

Recovery is the process of retr ieving or freeing immobile, inoperative, or abandoned materiel from where it was disabled or abandoned and returning it to operation or to a place where it can be repaired, evacuated, or otherwise disposed. Recovery is performed to--

- Return immobilized equipment to operation.
- Retrieve equipment for repair and/or return to user.
- Prevent enemy capture of equipment.
- Use enemy equipment for intelligence purposes or for US or allied forces.

5-3. ORGANIZATION FOR SUPPORT

Recovery is a using unit's responsibility. Using units are organized, staffed, and equipped to recover their own equipment. Recovery operations in armor and mechanized infantry battalions are centrally managed at battalion level, usually by the BMO. The battalion maintenance platoon has recovery vehicles to provide recovery support. The platoon has company maintenance teams, each of which has an organic recovery vehicle. The BMO is usually in charge of recovery operations. In other units, the motor sergeant, motor officer, or other designated individual performs this function. Maintenance units are responsible for recovering their own organic equipment and providing backup support when requirements exceed the unit maintenance capability. They may also be tasked to provide recovery support on an area basis to units without a recovery capability.

5-4. RECOVERY PRINCIPLES

The following general principles apply to conduct of recovery operations:

- Using units recover their own disabled equipment. The unit should secure the equipment, attempt repair using local support, and arrange for unit maintenance support when required.
- Recovery priorities must be established. Convoy movements may need recovery vehicle support. Units may need additional recovery vehicles based upon assigned weapon systems or who has the main effort.

- A 24-hour capability is required. All operations require continuous, responsive, recovery support. Roadside recovery may be rotated among maintenance units to provide limited backup support.

- All other options should be tried before using a recovery vehicle. Field quick-fix repair permits the equipment to complete the mission before more permanent repairs are performed. Self-recovery and like-vehicle recovery may get the equipment operating or bring it to a repair point.

- Towing more than one disabled vehicle is limited by the capability of the recovery vehicle. The combined load may exceed the recovery vehicle's braking power on a steep grade.

- Wreckers normally recover wheel vehicles, but may also recover light track vehicles. Track recovery vehicles recover track equipment. Select the proper recovery vehicle when supporting an increased work load with only a few recovery vehicles. The recovery manager may adjust these guidelines based on the need set by the commander.

- When recovery vehicles are limited, the commander must determine the need for the item. Combat vehicles should generally be recovered before tactical vehicles. The type of disabled vehicle also affects the need when recovering two or more like items. The following priorities will usually give the highest return for the effort expended:

  - Vehicles that are stuck.
  - Items with failed or damaged components needing little repair.
  - Damaged items needing major recovery and repair efforts to return them to service.
  - Contaminated items. (Recovery should only be attempted if a like item is not available.)
  - Items damaged beyond repair.
  - Enemy materiel. (Intelligence requirements may raise the priority for recovery of enemy materiel.)

- To keep recovery vehicles available in the forward areas, do not use them to return equipment any farther to the rear than necessary.

- Recovery managers must have correct location information to give to the recovery crews. Ground guides from the supported unit may be required when specific location information is to be given to the recovery crews. Ground guides from the supported unit may be required when specific location information is not available or where friendly lines are not well defined.

- Recovery operations should be coordinated with the maintenance effort. Commanders set guidelines for the maximum time to be spent on repair at various locations. These provide maintenance and recovery managers a basis for the repair or recover or evacuate decision for each inoperable item. The estimated repair time may also indicate the best repair point for the item. Maintenance time guidelines maybe set by unit SOP or for specific operations.

- Recovery operations must not interfere with the tactical plan.

- Recovery missions requiring more than a 3:1 mechanical advantage may need more time to perform. The recovery decision must consider the importance of the item, tactical situation, and time recovery equipment will be unavailable.

- During tactical operations, recovery vehicles are exposed to enemy fire. The commander must decide if the value of recovering a disabled vehicle near enemy forces outweighs the possibility of losing a recovery vehicle and/or crew.

- Recovery must not cause further damage to equipment. Crews must be skilled in correct rigging techniques and safety requirements.

5-5. RECOVERY OPERATIONS

Recovery is initiated by the operator/crew of the disabled vehicle. Before requesting recovery support, the operator/crew should attempt repairs and self- or like-vehicle recovery using their own resources as well as those of nearby unit elements. When the tactical situation makes this impossible, assis-

tance is requested from unit maintenance. The BMO evaluates the request for assistance based on command guidance and the overall tactical and maintenance situation and then develops a recovery plan. The recovery mission is assigned to a recovery team, which accomplishes the recovery according to unit SOP. Equipment is recovered either to the battalion UMCP or to a designated MCP. Details of recovery operations are found in FM 20-22 and FM 43-5.

5-6. SPECIAL CONSIDERATIONS

Operations in an NBC Environment. Recovery and maintenance personnel must be alert to the possibility that recovered equipment may be contaminated. Recovery teams must be capable of testing equipment for chemical and radiological contamination. Chapter 3 discusses details of NBC defense in support of maintenance operations. Working in MOPP 4 has a drastic affect on the length of time needed to accomplish recovery and maintenance operations.

Offensive Operations. When offensive operations have been successful, combat and support units move in a forward direction. Lines of support are extended. In this situation, recovery procedures may need to be modified. Instead of recovering items to established MCPs, equipment may be recovered to the MSR servicing the area and left there with appropriate security to await the arrival of support elements. The maintenance unit commander must plan for offensive operations and recommend locations of proposed future collecting points along the MSR. While the combat operation is underway, good communications with the supported unit BMOs are essential in order to pinpoint location of disabled equipment. Since the maintenance unit may also be involved in a unit move, special attention must be given to continuous support.

Defensive Operations. Defense may be static or dynamic in nature, involving either little or substantial movement. During static operations, emphasis should be placed on alternate routes of approach and recovery. Recovery personnel should be able to estimate the resistance of vehicles disabled by terrain, as well as determine which terrain will allow for fastest routes of approach and recovery. During a retrograde operation, the recovery and maintenance assets of the supported battalions will be heavily used. Nonmission capable but mobile equipment should be used to recover like equipment to the maximum extent possible.

Night Operations. Night recovery operations are, in general, conducted the same as during the day. Recovery elements may need additional night vision devices and assistance from the supported unit by way of guides and security. Light and noise discipline is important, and if the recovery operation requires that either be broken, approval must be obtained from the tactical unit commander concerned. When tactical elements are conducting night operations, maintenance units should anticipate an increase in work load due to an increase in accidents and numbers of mired vehicles.

Foreign Materiel. Technical recovery of foreign materiel is the same as for US materiel. Special attention must be given to the possibility of booby traps.

Disposition instructions for foreign materiel are provided through intelligence channels. Division SOP and/or disposition instructions may route some or all of these items through the supporting maintenance units.

COMSEC. Maintenance units must be on the alert that COMSEC is not compromised in the coordination for recovery support. Also, recovered equipment should be inspected for the possibility that controlled cryptographic items (CCI) may have been left in the equipment. All CCI must be zeroed prior to turn-in.

5-7. EVACUATION

Evacuation moves materiel from a support MCP or activity to another CSS activity for repair, cannibalization, or further disposition. Evacuation is a logistics function and provides a flow of disabled equipment into the logistics support system. Evacuation is performed to--

- Reduce the maintenance backlog at a certain location.
- Move damaged equipment to a maintenance activity that can do the repair.
- Make equipment available for cannibalization.
- Make use of critical supplies and equipment.
- Match the maintenance work load with maintenance resources.

5-8. ORGANIZATION FOR SUPPORT

The Assistant Chief of Staff (ACofS), G4 sets the overall division evacuation policy in coordination with the DISCOM commander. The DISCOM commander has overall evacuation control that is exercised through the DMMC. The physical movement of equipment is done by the maintenance, supply, and transportation units of the DISCOM, according to set procedures or in response to disposition instructions from the DMMC. Backup evacuation support may be provided by the COSCOM. Division maintenance units have a limited capability for evacuation of heavy equipment. Support for this is provided by the Transportation Motor Transport Company of the division MSB.

5-9. EVACUATION PRINCIPLES

The evacuation process must be managed to result in the eventual return of the maximum number of serviceable items to using units or to the supply system. This requires close coordination of recovery, repair, and transportation. The following principles apply:

- The CSS system evacuates equipment to proper destinations, after it is recovered, to support activities by using units.
- Evacuation is accomplished by the fastest means available.
- Evacuation priorities are like those for recovery. Items most critical for the battle are evacuated first.
- Intermediate handling must be avoided. The evacuation channel should be as streamlined as possible. Disposition instructions should ensure evacuation to the maintenance activity best suited for repair.
- Maximum use is made of available transportation. Evacuation vehicles may backhaul unserviceable assemblies and end items on the return trip. Vehicles delivering supplies in the forward areas may be used to evacuate items to the rear.
- Further damage of equipment must be prevented. Packaging, bracing, and preservation materials should be used to protect the items from the elements and from damage while in transit.

5-10. EVACUATION OPERATIONS

Evacuation is done under the overall management of the Division Movement and Control officer.

MCPs of maintenance units serve to collect unserviceable equipment. The location of these points should support later evacuation. The MCP should support the tactical operation, be on or near the MSR, and on a road network that can support HET operations.

Items for evacuation are identified at the maintenance company level. These consist of unserviceable equipment beyond the repair capability of the unit, unserviceable assemblies from the repair process, and serviceable and unserviceable abandoned items found on the battlefield.

The DMMC provides overall management for the evacuation effort. It acts as the interface between the maintenance companies of the FSBs and other CSS elements to the rear of the brigade boundary. Evacuation policies and procedures are set as a matter of SOP. Automatic disposition instructions for certain items prevent undue delay in moving equipment from the brigade to the DSA.

Maintenance units request disposition instructions from the DMMC through the battalion support operations section for items not covered by automatic disposition lists.

Transportation for equipment to be evacuated is provided by maintenance unit assets, resupply vehicles returning to the rear, or vehicles provided in response to unit transportation support requests. For heavy equipment transportation, the maintenance units depend on the HETs of the transportation motor transport (TMT) company.

Evacuation vehicles transport unserviceable assemblies and major end items according to disposition instructions from the DMMC. They also may backhaul serviceable assemblies and end items from rear repair activities to the forward maintenance or supply elements. HETs and other cargo vehicles bring major replacement items forward. Their operations are closely coordinated at the DMMC with the division WSRO.

5-11. SPECIAL CONSIDERATIONS

Fast-Moving Operations. The evacuation work load may be expected to increase during fast-moving operations. The opportunity for repair at the forward locations is limited since maintenance elements are on the move. Only relatively simple repairs are

done. More complex jobs are recovered to the MSR to wait for evacuation to a repair activity.

Bridge Capacity. The weight of the loaded HET makes the load-bearing capacity of bridging, to include tactical bridging, critical. The weight of the M1 tank/HET combination will severely restrict available routes. This places a premium on route planning and traffic control,

5-12. TRANSPORTATION

Maintenance units make frequent use of transportation service support as part of normal maintenance operations. An understanding of the capabilities of divisional transportation units and the procedures for obtaining their support is, therefore, important. Ground and air transportation units may provide--

- Transportation of maintenance personnel and repair parts to expedite maintenance operations.
- Evacuation of unserviceable items and components.
- Delivery of serviceable parts, assemblies, and supplies.
- Assistance in unit moves.

5-13. ORGANIZATION FOR TRANSPORTATION OPERATIONS

Transportation operations in the heavy division fall under CS and CSS.

Ground Transportation. The TMT company of the DISCOM provides CSS transportation to all combat elements of the division. The support provided includes--

- Motor transport for unit distribution of Classes I, 11,111 (packaged), IV, VII, IX, and emergency Class V.
- Movement of personnel.
- Displacement of division units with less than 100-percent organic mobility,
- Displacement of division reserves for which the TMT company is responsible.
- The TMT company provides for transport of tanks, armored vehicles, heavy track and/or wheel vehicles, and heavy or outsize cargo, The unit is equipped with 24 HETs, and based on 75-percent availability, can make a one-time lift of 18 tanks or tank equivalents. The unit has the capability to--
  - Evacuate heavy and outsized vehicles to maintenance facilities.
  - Displace armored elements within the division.

  Displace division reserve supplies.

  Transport heavy equipment within the division area of operations.

Air Transportation. Tactical air movement of troops, supplies, and equipment is provided by the combat support aviation company (CSAC) when that unit is used to support the combat support aviation battalion (CSAB) of the combat aviation brigade (CAB). Medium lift helicopter (MLH) transport is provided by the medium helicopter battalion of the corps, The CSS tasks for air transport are similar to those for more transport. Air transportation tasks include transport of maintenance personnel and repair parts when needed to do critical repairs. Air transportation may also be used to evacuate critical items.

The brigade headquarters is a command and control headquarters and has no transportation staff or assets. The assigned DISCOM FSB support operations section coordinates CSS missions between the brigade S4 (or XO) and the DISCOM elements operating in the BSA.

The division staff has a transportation management element consisting of division transportation officer (DTO), DISCOM movement control officer, and movement specialist. The DTO is a staff planner who works under the staff supervision of the ACofS, G4. DTO coordinates with the ACofS, G3 on tactical troop moves and operations and with the ACofS, G4 on logistical and administrative matters. The DTO provides the DISCOM MCO with policy guidance, plans, and assistance in all transportation matters. The ACofS, G3; ACofS, G4; and DTO et transportation priorities and provide them to the DISCOM movement control officer.

The DISCOM movement control officer heads the DISCOM transportation staff. The staff are primarily operators, but must also plan for use of transportation assets. They control the use of the DISCOM motor transport assets and division aircraft allocated to the DISCOM for logistical support, The DISCOM

movement control officer must coordinate with users, transportation units, and transportation mode operators to ensure that transport equipment is provided as required and is properly used. The DISCOM movement control officer coordinates with the support operations section of the MSB for use of the DISCOM motor transport assets. The DISCOM movement control officer coordinates with the DTO to obtain transportation resources from other than DISCOM units. These resources maybe provided by other division units or by the COSCOM MCC.

5-14. PRINCIPLES OF TRANSPORTATION

Transportation managers apply basic principles of transportation to obtain the maximum benefit from the transportation capability. These principles apply to all modes of transport, at all levels of command. They include--

Centralized Control of Assets. Control of assets must be centralized under the commander charged with providing integrated logistical support to the division. The DISCOM movement control officer performs this function for the DISCOM commander,

Fluid and Flexible Movements. The division transportation system must be able to provide an uninterrupted flow of traffic and adjust to changing situations. Effective use of all transport capabilities must provide means to divert, reroute, or ensure continuous movement of supplies to supported units.

Maximum Use of Carrying Capacity. This involves more than just loading each transport vehicle to its maximum carrying capacity. Transport used one day cannot be stored to provide an increased capability later. Similarly, fully loaded transport equipment sitting idle is just as much a loss of carrying capability as a partially loaded vehicle moving through the system. Tactical situations, however, may not always permit complete adherence to this principle. For example, vehicles or aircraft may be held for special missions or projects. Such use, when directed by the commander, is considered proper use of the vehicles or aircraft.

Regulated Movements. Maintaining and supporting highly mobile forces greatly increases the need to regulate movements as the volume or logistical and tactical traffic increases. Regulation and coordination are required to prevent congestion and conflict of movements. It is likely that US forces will have to share available airfield, road, rail, and inland waterway capabilities with allied forces and civil commerce.

5-15. HOW TO GET TRANSPORTATION SUPPORT

Requirements for transportation support can originate at any level with the division. Requests for support must provide all the information needed to allow the transportation manager and mode operator to determine the best way to provide support.

Request for Support. As a minimum, the transportation request must include the following information about the cargo to be transported:

- Origin - location of cargo.
- Destination - where cargo is to be delivered.
- Weight - cargo in pounds.
- Dimensions - length, width, and height in inches.
- Description - what is to be transported.
- Unusual characteristics - if any.
- Dangerous characteristics - flammable, explosive, and so forth.
- Delivery - required time and date.
- Information- any other data that will assist in providing the required service.

Requests for transportation support are processed through support channels. The mode of transport to be used is determined by priorities set by the division staff.

Motor Transport. The division staff provides the DISCOM priorities for the use of division motor transport resources. At the DISCOM, motor transport assets are matched against transport requirements in support of maintenance operations versus other requirements and priorities are established. Based on these actions, the DISCOM movement control officer directs the TMT company to provide assets to meet given requirements. When division requirements for motor transport exceed the available capability, the DTO requests additional support from the COSCOM movement control officer.

Air Transport. Request for airlift sorties in support of maintenance operations are passed through support channels from the requester to the DTO. The DTO coordinates with the DMMC, which instructs the MSB to prepare supplies for airlift and deliver them to the designated pickup point. The DTO contacts the G3 air and requests that the mission be flown. When allocated or planned airlift sorties by corps aviation units are used, the DTO sends the request for the airlift mission to the corps movement control center (MCC). If supplies to be airlifted by corps aircraft are to be picked up in the COSCOM area, the DMMC coordinates the pickup with the COSCOM MMC and the DISCOM MCO.

CHAPTER SIX

MISSILE MAINTENANCE

6-1. MAINTENANCE SUPPORT

Maintenance support of missiles and air defense gun systems includes the following services:

- Repair and modification.
- Missiles (less Class V components, warheads, and adapter kits).
- Missiles and gun-peculiar fire control, launching, test, and handling equipment.
- System-peculiar training devices.
- System-peculiar power generation and environmental control systems.
- Man-portable common thermal night sights (MCTNS).
- Maintenance alignment of missile-peculiar test and handling equipment.
- Technical assistance and training to supported units.
- Missile support team to provide on-site maintenance when required.

6-2. ARMY MISSILE SYSTEMS

Army missile systems within the heavy division are divided into two classes: land combat missile systems (LCMS) and air defense missile systems. The term "missile systems" as used in this chapter also applies to radar controlled air defense gun systems and to free-flight rocket systems.

6-3. LAND COMBAT SYSTEMS

Land combat systems are those missile systems used to engage ground targets. They include antitank missiles, nuclear, and conventional missile-delivered artillery. These are TOW (several versions exist; for example, ground TOW, Improved TOW Vehicle (ITV), jeep-mounted TOW, and Bradley Fighting Vehicle (BFV) TOW subsystem), DRAGON, Multiple Launch Rocket System (MLRS), and Man-Portable Common Thermal Night Sights (MCTNS).

6-4. AIR DEFENSE SYSTEMS

Air defense systems are those systems used to engage airborne targets (aircraft and helicopters).

They include man-portable missile systems, SHORADS, and medium to high altitude air defense systems, They are Stinger, REDEYE, Chaparral, Vulcan, and Forward Area Alerting Radar (FAAR).

6-5. MISSILE MAINTENANCE SUPPORT

The maintenance support structure of missile systems is based on the same principles of conventional maintenance. The relative low density of missile systems, combined with their sophistication and complexity, place high work loads on all missile support units. All missile systems require unit, direct support, general support, and depot-level maintenance. The extent to which repairs are done at the direct support level depends to a large degree on the capabilities of the personnel, test equipment, and availability of materiel at the missile support unit. DA maintenance provides for the repair and return to the user of their missile systems and major components. A large percentage of work is repair of chassis to support RX assets. GS maintenance performs repairs requiring more time or more sophisticated test equipment. GS and depot level repairs are completed and the equipment is then returned to the supply system.

Missile and air defense systems in the division are supported by the missile support maintenance company organic to the DISCOM MSB and located in the sion rear. LCMSs organic to brigades are supported by the FSB maintenance company. The support provided by the missile company is divided into two categories: base shop and MSTs.

6-6. BASE SHOP

The base shop of the company provides DS maintenance and RX and supply support. It is equipped with sufficient manuals or automated test equipment (ATE) to enable it to perform all required DS maintenance tasks and perform electro-optical alignment on LCSS and air defense missile systems. Repair of any component that requires more than 24 hours effort becomes the base shop's responsibility. The base shop is equipped with the LCSS shop set.

6-7. MAINTENANCE SUPPORT TEAM

MSTs for SHORADS are deployed with the tactical unit. MSTs for LCMS and MCTNS are deployed with the division engineer battalion, armored cavalry squadron, and the MLRS battery. MSTs will be equipped with tools and test equipment appropriate to the system being supported.

6-8. MAINTENANCE RESPONSIBILITIES

The operator/crew is responsible for cleaning/servicing and lubricating the system. They tighten all bolts and nuts and spot paint the system as outlined in the -10 level technical manual. They are responsible for maintaining all fluid levels and any other maintenance authorized by the MAC.

Unit maintenance personnel perform PM including visual inspections, testing, cleaning, tightening, and other minor adjustments; make external adjustments on equipment and perform operational checks using appropriate tools and test equipment. Further, they make continuity and operational checks, analyze the causes of equipment failure to the module, using built-in test equipment (BITE) and other diagnostic and fault isolation equipment; repair end items by replacing modules which are authorized by the MAC chart, and evacuate unserviceable beyond unit repair capability to the designated DS support unit.

DS maintenance units can perform, supervise, and inspect all maintenance functions authorized at lower levels of maintenance, although normally they will only supervise or inspect unit maintenance. DS units--

- Repair and replace end items of equipment and replace modules with the use of complex tools and test equipment.
- Troubleshoot, inspect, test, adjust, and align those modules that are authorized by the MAC.
- Replace defective modules that are beyond the capability of unit maintenance.
- Evacuate unserviceable items to the level of maintenance prescribed by appropriate publications.
- Repair equipment using conventional piece-parts such as transistors, capacitors, diodes, transformers, relays, and so forth.

These units also provide quick reaction maintenance support through the use of RX. They provide forward maintenance support and technical assistance through the use of mobile missile support teams. Support services for items evacuated by the

user requiring repair are handled by use of the RX system, where possible, or on a repair and return to user basis. The DS unit also provides technical supply support, technical assistance, maintenance calibration, and load testing and performs modifications when specified by MWOs. Unit and support maintenance are provided for organic system-peculiar test and handling equipment. DA units can provide support services for missile repair when required by Class V activities such as ASPs or special ammunition supply points (SASPs).

Any maintenance which is beyond the capability of those levels described above will be performed by GS units.

6-9. MISSILE MAINTENANCE INTERFACE WITH AMMUNITION UNITS

Most smaller missiles are Class V items and, as such, are not routinely handled by missile support units. This particularly applies to the TOW, Dragon, Chaparral, MLRS, HAWK, and Patriot missiles, Missile support units do, in some cases, stock Class IX components of the missiles that are required for unit repair or checkout (fins, wings, nuts, bolts, screws, desiccant, and so forth). Should any missile require repair or fail a confidence test, it will be transported by the firing unit to the ASP for repair or exchange.

CHAPTER SEVEN

CONVENTIONAL AMMUNITION MAINTENANCE

7-1. CONCEPT

A unit going into battle must have serviceable ammunition. A round that fails to chamber at a critical time may result in the death of a rifleman or the loss of a tank and its crew. The purpose of ammunition maintenance is to make sure that ammunition is serviceable when needed.

7-2. GUIDANCE

Using units rely upon the division ammunition officer (DAO) for guidance on the level of maintenance they can perform. This is limited to preservation and packaging operations; however, it may include cleaning, removal of minor rust and corrosion, repair and replacement of boxes, and restencilling of containers.

Using unit maintenance is performed by organizational personnel and is limited to care and preservation actions. Ammunition technical manuals contain detailed instructions on the care, handling, preservation, storage, and maintenance of ammunition.

Personnel must read and follow the warnings contained in the manuals. For example:

WARMING

Handle explosive ammunition and components containing explosives with utmost care at all times. Do not drop, drag, throw, tumble, or otherwise strike boxes containing ammunition or related components. Explosive elements in primers and fuzes are particularity sensitive to shock and temperature extremes.

Ammunition is packed to withstand normal field conditions and handling. The majority of ammunition maintenance requirements involve ammunition which, for various reasons, has been removed from protective containers or packaging. There is a direct relationship between how the ammunition is stored and handled and how much maintenance has to be performed. Thus proper ammunition storage and handling are critical to ammunition maintenance.

Maintenance actions beyond preservation and packaging will be performed by the supporting conventional ammunition company.

The division or COSCOM missile support unit performs inspections, electrical tests, and verification on selected rocket and missile systems, Unit TOE indicates which conventional ammunition or missile unit has tools, skills, test equipment, and repair parts to perform DS maintenance on a Class V item or Class V training item. Using units may call on supporting ammunition companies to furnish technical advice and assistance when preparing to perform care and preservation on ammunition.

ALL AMMUNITION MUST BE PROTECTED FROM FIRE AND SPARKS. AN EFFECTIVE FIREFIGHTING PLAN IS AN IMPORTANT PART OF ANY STORAGE PLAN.

7-3. STORAGE, HANDLING, AND SAFETY

Personnel who handle ammunition must recognize unsafe conditions. Improper, rough, and careless ammunition handling may result not only in malfunctioning, but may cause accidents that kill or injure personnel and cause extensive property damage.

All ammunition should be unloaded before conducting maintenance operations. BDR manuals discuss risks associated with maintenance of uploaded weapon systems. During combat, however, the commander may consider these risks acceptable under certain conditions.

All ammunition must be protected from fire and sparks. An effective firefighting plan is an important part of any storage plan.

7-4. CARE AND PRESERVATION

Major commands publish regulations for inspection of basic load ammunition in the theater of operations. These regulations may be supplemented by letters of instruction from division headquarters and external SOPS from units which operate the ammunition supply points (ASP). These documents contain detailed information on care and preservation as well as specific inspection requirements for basic load ammunition. They also provide information on procedures for periodic rotation of the basic load by turning portions in to the supporting ASP or expending it during training. Some ammunition may be unsatisfactory for retention as basic load, but can still be fired. Specific procedures for unit maintenance of ammunition are contained in TM 9-1300-250.

When correct storage and handling procedures are followed, the care and preservation requirements are relatively small. One important care and preservation element involves support of firing exercises. Ammunition that is drawn from the ASP is often returned in an unserviceable condition.

Storage locations must be set up so that personnel can perform perservation and packaging maintenance. While it may be necessary to evacuate stocks for maintenance, a program based totally on evacuation is usually not feasible.

Unused ammunition should be repacked in original containers and returned to the supporting ASP to keep it from being used by the enemy. Ammunition returned to the ASP with original containers not opened (seals and binding intact) will be only sample-inspected for condition unless damage is suspected or obvious. All ammunition with original containers opened (seals or banding broken) must be

100 percent inspected for condition. Inspection for every round is a time-consuming process, and the customer unit must furnish personnel to unload, unpack, and reload (for movement to storage location) the inspected ammunition.

7-5. TECHNICAL ASSISTANCE SUPPORT

Using units may request technical assistance for ammunition from its supporting ASP. Ammunition specialists and military ammunition inspectors are assigned to ammunition battalions and work at the ASP, one of their duties is to give technical assistance to supported units. Since they are experts in storage and handling, they can provide ideas on how the unit can improve their operations. Ammunition inspections are usually made on an annual basis to see that the basic load is stored IAW theater regulations, and unit commanders are notified of the results. When unusable ammunition stocks are identified, a follow-up inspection is normally conducted within 60 to 90 days after the initial inspection. This ensures that the necessary turn-in has been made and the serviceable replacement has been made.

7-6. AMMUNITION FAILURES.

Theater regulations state reasons and requirements for notifying the local ammunition officer at the ASP or the supporting ordnance battalion of failures. A quality assurance specialist will normally come to the scene of the failure and assist in the investigation and preparation of reports.

CHAPTER EIGHT

COMMUNICATIONS-ELECTRONICS (CE) EQUIPMENT

SECTION 1. MAINTENANCE

8-1. COMMUNICATIONS-ELECTRONICS EQUIPMENT

Effective command, control, and communications depends on keeping a variety of CE equipment operational through timely repairs, Equipment to be supported includes the following:

- Radios.
- Teletypewriters.
- Switchboards.
- Telephones.
- Multichannel equipment.
- Night observation devices.
- COMSEC equipment.
- Avionics equipment.
- Ground support radar.
- ADP equipment.
- Special purpose TMDE used with or in support of the above.

SECTION Il. ORGANIZATION FOR SUPPORT

8-2. MAINTENANCE ORGANIZATION

Maintenance responsibility for CE equipment is shared by the various divisional units as shown in Table 8-1 on the following page.

8-3. MAINTENANCE FUNCTIONS

MACs for CE equipment organize maintenance support into the four levels common to all Army equipment. The following discussion describes the CE maintenance functions done in the division.

Unit Maintenance. The operator/crew performs limited maintenance functions. These are normally limited to external cleaning/dusting, checking and tightening external connector, and sight/touch inspection of the equipment and its operating controls. No internal tightening or adjusting is performed at this level.

Unit maintenance personnel perform PM and analyze the cause of equipment malfunction to the line replacement unit (LRU). The unit maintenance personnel use built-in test equipment (BITE) and authorized special and general purpose tools and TMDE. Items requiring higher level repair are sent to the supporting DS maintenance activity.

Table 8-1. Communications-electronics maintenance organization.

Unit/Activity	Equipment/Units Supported	Type Spt	Remarks
Using Unit	Organic C-E equipment	Unit	
Aircraft Operating Unit (10 or more aircraft)	Organic avionics equipment	AVUM	
Trans ACFT Main Co	Avionics equipment in supported units	AVIM	Also AVUM for units with less than 10 aircraft
Signal Bn and CEWI	Organic C-E equipment	Direct Support	
Maint Co FSB Fwd Spt Maint Co	C-E equipment in supported BSA units	Direct Support	
Light Maint Co MSB Headquarters & Spt Co Headquarters & Light Maint Co	C-E equipment and COMSEC in supported units	Direct Support	Except MSL/ADA peculiar items. Also provides backup support to Sig Bn,MI Bn (CEWI), and Maint Co FSBs
Msl Spt Co,MSB/Mnt Bn	MSL/ADA peculiar C-E items in DSA units	Direct Support	

DS Maintenance. DS maintenance is performed in support of the user. The repairer may perform unit maintenance functions when proper tools/TMDE and expertise are available.

DS diagnostics and repair is done with authorized TMDE, automated test equipment (ATE), and tools. Repair, adjustment, and calibration of LRUs is done as authorized by the MAC. Equipment beyond the DS maintenance activities capacity/capability is evacuated to a backup COSCOM DS maintenance unit, or to the supporting EAC GS level activity.

8-4. MAINTENANCE OPERATIONS

Maintenance of CE equipment involves special considerations, which affect the way support is provided, Diagnostic checks and troubleshooting procedures normally require TMDE and maybe time consuming. This limits the amount of on-site maintenance which can be performed. Items are usually brought to the electronics shop to be diagnosed and repaired. Initial or acceptance inspections check for obvious damage and completeness.

RX expedites support to using units. Many CE items are not accounted for by serial number. A transaction for these items may be made on an RX rather than a property book basis. The exchanged unserviceable item is sent to the shop for repair and returned to RX stocks.

The BITE and the TMDE brought along by the MST may identify the fault to a specific part or subassembly. When the faulty part can be identified, on-site repair may be possible by replacement or exchange. The nature of most failures limits the quantity and type of parts which can be carried by the MST.

8-5. COMMUNICATIONS SECURITY (COMSEC) EQUIPMENT MAINTENANCE

The maintenance of COMSEC materiel is greatly affected by security requirements concerning personnel, operations, and maintenance. The requirements are contained in AR 380-40 and AR 640-15. Signal security includes COMSEC electronics security (ELSEC) and TEMPEST. COMSEC involves crypto security, transmission security, emission security, physical security of COMSEC equipment and information, and measures to ensure communications are genuine. ELSEC protects electromagnetic transmissions other than communications devices, It includes approved operating procedures, proper siting techniques, maintenance practices, and training programs. TEMPEST invol-

ves the study, evaluation and control of compromising emanations, COMSEC equipment maintenance support is integrated into the overall division, COMSEC operations, and support organization. Details of COMSEC logistics support are found in TB 380-41 series.

The division CE officer implements the COMSEC policy within the division. This officer provides overall staff management of operational COMSEC matters and establishes priorities for issue of COMSEC material.

The DMMC is the focal point for division COMSEC management. COMSEC maintenance support is integrated into the DISCOM and other maintenance elements. The signal battalion and military intelligence (MI) battalion perform DS maintenance on organic peculiar COMSEC equipment.

The COMSEC materiel management section of the DMMC manages overall COMSEC logistics operations and translates the staff guidance from the division CE office into daily operations. COMSEC materiel management functions performed by this section include--

- Requisitioning, receiving, storing, issuing, accounting for, and destroying COMSEC materiel.
- Processing and controlling all transactions which affect COMSEC accounting records in the division.
- Issuing COMSEC materiel based on priorities from the division communications electronics officer (CEO).
- Monitoring physical security measures and accounting procedures.
- Ensuring MWOs are applied and reported.
- Submitting COMSEC materiel readiness reports.
- Establishing subaccounts and/or hand receipts as required.
- Authorizing and positioning ORF to meet mission requirements.
- Maintaining the division COMSEC parent account.

The DISCOM MSB, with the light maintenance company, performs the following functions:

- Plans and directs forward direct support maintenance for COMSEC material.
- Maintains the division ASL.
- Operates the division COMSEC RX program.
- Establishes a COMSEC materiel subaccount / hand receipt.

COMSEC maintenance support is provided by the light maintenance company of the MSB, the signal battalion, and the MI battalion. Each supporting element does the following functions:

- Establishes a subaccount.
- Performs COMSEC DS maintenance for supported equipment.
- Maintains a shop stock of COMSEC repair parts and RX items in support of organic maintenance operations.
- Requests disposition instructions from the DMMC for excess COMSEC materiel.

The maintenance companies of the FSBs and transportation aircraft maintenance company (TAMC) maintain a limited RX of COMSEC equipment.

8-6. ELECTROMAGNETIC PULSE (EMP)

CE operations in a nuclear environment present unique problems which may greatly affect the maintenance work load. In addition to the effects from the blast, thermal effects, and radiation, CE equipment is subject to damage from EMP, EMP begins with the release of nuclear radiation, primarily gamma rays. A process of ionization forms strong electromagnetic fields. EMP is a high amplitude, broad band width, pulse of short duration. The frequency generated by EMP covers most of the usable frequency band. Most of the EMP energy is in the high frequency and very high frequency range. FM 11-50 contains a further discussion of EMP characteristics.

8-7. EMP DAMAGE

EMP damage results from excessive electrical energy being introduced into equipment. Systems using semiconductor technology and low voltages are most affected, Damage may range from tripped circuit breakers or blown fuses, loss of information being stored or processed, to burned-out transistors and coils, and destruction of power supplies and complete assemblies

8-8. PREVENTIVE MEASURES

EMP may enter electrical systems through intentional antennas, unintentional antennas, and direct penetration. Cables, wires, antenna systems, and other metal structures are good electrical conductors and all absorb EMP energy to varying degrees. These conductors interact with the electromagnetic energy to induce voltages and currents. The key to protection from EMP damage is to install and operate equipment so as to minimize the induced energy and keep it from reaching sensitive cornponcnts.

Intentional antennas are standard radio antennas. Damage may be lessened by using the highest frequencies possible and by using horizontal antenna polarization. The best protective measure is to disconnect the antenna. To minimize damage, all spare equipment must be disconnected from coax cables, antennas, power sources, and all cables and wires.

Unintentional antennas may be devices that act as antennas, such as masts, wiring loops, and cables. Unintentional antennas can be avoided by--

- Keeping the lengths of cable and wire as short as possible since the amount of energy collected is directly related to the length of the cable or wire.
- Burying all cables and wires, including power cables, at least 18 inches deep.
- Ensuring wire or cable coiled on a reel is not connected to equipment. The coil will pick up more EMP than straight cable,
- Using a common ground for all equipment, shelters, and power sources.
- Ensuring that all antenna guy lines are properly insulated.
- Ensuring commercial power sources are not used. This type power is extremely susceptible to EMP.

Direct penetration of EMP into equipment results from a lack of shielding. Internal electronic components can act as loop antennas and allow strong electromagnetic fields to be created inside the equipment. Shielding equipment prevents direct penetration of EMP. Shielding effectiveness is related to the shielding material and its thickness. For effective electrical field shielding, any metal (iron, aluminum, and so forth) can be used; for magnetic shielding, iron or steel is required.

Unit SOPS and directives concerning installation, operation, and storage are essential to minimize the effects of EMP. CE items in the current inventory are not designed (hardened) to withstand the effects of EMP. Thus, measures to reduce vulnerability of CE equipment must be used in the field.

PM and daily inspection have added importance in an NBC environment. Cables and wires with damaged shielding or connectors must be replaced. Power system filters must be checked and replaced or repaired as necessary. Alternate or backup equipment must be kept ready; however, this equipment may be inoperable because of EMP. Maintenance personnel must respond with required repair parts.

If possible, disconnect all external cabling, turn off or unplug all equipment, and disassemble antennas.

CHAPTER NINE

SUPPLY OPERATIONS

SECTION I. SUPPLY SUPPORT OPERATIONS

9-1. SUPPLY SYSTEM LEVELS

Supply system has two levels, wholesale and retail.

- Wholesale. This includes the NICPs, supply depots, arsenals, central wholesale data banks, plants, factories associated with commodity command activities, and special Army activities controlled by HQDA. The wholesale supply systems is concerned with procuring supplies from the manufacturer and bringing those supplies into the Army inventory.

- Retail. The retail level includes all portions of the supply system which are not classed as wholesale. It is subdivided into user, DS, and GS echelons.

  - User. Users are combat, combat support, and combat service support units which stock supplies to support their own operations. These stocks are called prescribed load lists (PLL) for Class IX and basic or operational loads for other classes. Users are also called customers.

    DS. DS supply units stock supplies for issue to user units. Stocks at the DS level are called authorized stockage lists (ASLs). Each DSU has a list of customer units to which it provides support. Stock control and accounting for DSUs in the division is performed by the division materiel management center. Nondivisional DSUs perform their own stock control,

    GS. GS supply units provide backup supply support to DS supply units and act as transshipment points. Stocks at this level are also called ASLs. GSUs are not located in the division, but are found in the Corps Support Command (COSCOM), Theater Army Area Command (TAACOM), and the Theater Army (TA). Their stock control and accounting are performed by a COSCOM MMC, TAACOM MMC, or TAMMC.

Supply-related activities, such as salvage collection points, reduce demands on the supply system through their reclamation actions. This is done by removing serviceable or economically reparable components, assemblies, and repair parts from end items or large components that have been classified as uneconomically reparable. Maintenance and supply must work together to provide, keep, and maintain the authorized amount of equipment in the using unit. If the cost of repair exceeds established expenditure limits, the item is turned in, unless approval to retain the item is obtained from the appropriate commodity command.

9-2. PRESCRIBED LOAD LIST

TOE units which perform unit maintenance are required to stock a prescribed load of repair parts which helps to ensure that parts are on hand when needed. A PLL consists of parts: the combat PLL

and other stocks. This stockage is carried on a prescribed load list (PLL) or combat PLL. A PLL consists of unit maintenance repair parts that are demand supported, nondemand supported, and specified initial stockage for newly introduced equipment. A combat PLL consists of unit maintenance repair parts as described above, in addition to repair parts prescribed by a mandatory parts list (MPL) for equipment on hand.

While MPLs for aircraft are published in DA Pam 710-2-120, MPLs for ground equipment are published in DA Pam 710-2-117. Each unit is responsible for maintaining PLL records, submitting timely replenishment requests, and conducting inventories. All items must be on hand or on order at all times. PLL policy is found in para 2-20, AR 710-2. Manual procedures are found in Chapter 8, DA Pam 710-2-1. Automated procedures are in system user manuals.

9-3. AUTHORIZED STOCKAGE LIST

The ASL consists of those parts stocked in DS maintenance units in the division for issue to user units and to support their own DS maintenance operations. These parts are stored in and issued by the maintenance units, but stock control and accounting functions are performed by the Division Materiel Management Center.

There are several reasons for adding an item to the ASL. They are discussed in detail in AR 710-2, The DMMC, based on priorities established by the division commander, will establish the guidelines for issue, ASL design, or distribution, The DMMC is the common exit point for all requisitions and other supply documents for the division. The ASL lines are distributed among the units based on the critical combat needs of customer units. The maintenance companies of the FSB will stock repair parts that are combat essential to brigade units. The light maintenance company will maintain stocks that are combat essential to nonbrigade units and items needed to replenish the stocks of the other divisional maintenance units.

Division units submit repair parts requests to their support maintenance company. If repair parts are on hand, an issue will be made. If parts are not on hand, the request will be back ordered and a requisition passed to the COSCOM MMC. The COSCOM MMC prepares the MRO, back orders the requisitioned item, or passes the requisition to a higher source of supply, When issues are made by the CO S-COM MMC to the division, the parts are shipped to the light maintenance company. They provide the DMMC with the shipping documents received with the parts. The items are placed in a storage location (for ASL replenishment) or released to the customer if the request was a passing action. The DMMC will direct the forward movement of ASL stocks held by the light maintenance company whenever replenishment of the forward support maintenance companies' ASL is needed or to satisfy the noncritical needs of brigade customers.

9-4. REPARABLE EXCHANGE

Items authorized for repair at DS level may be supplied through a divisional RX activity. Selection of items for RX is determined by joint efforts of DISCOM supply and maintenance personnel. Items selected are those having a maintenance code of F which are currently job ordered to DS by using units on DA Form 2407/5504. Placing items on the RX list serves two useful purposes. The first is the users do not have to prepare a job order and await repair. An issue and turn-in is prepared on DA Form 2765 and the item is handcarried to the RX activity where a like item is issued. The second benefit is that only the supply activity job orders the components to DS for repair which reduces paperwork and allows DS to work load for programmed repair. Selection and stockage procedures are covered in DA Pam 710-2-2. The actual or anticipated repair frequency is at least nine times per year to place an item in RX and three times per year to retain. For aviation and missile items it is three times to place in RX and one time to retain.

Procedures for customers to obtain an item from the reparable exchange activity (RXA) are provided in DA Pam 710-2-1, The iterns are exchanged on a one-for-one basis using a DA Form 2765-1 to turn-in the unserviceable item and another DA Form 2765-1 to request the replacement.

9-5. WEAPONS SYSTEM REPLACEMENT OPERATIONS (WSRO)

WSRO is a management tool used to supply the combat commander with fully operational major weapon systems including both required equipment and trained crews. Procedures for issue of weapon systems differ from those for the issue of other Class VII items.

Two terms which are often used to describe WSRO are ready-for-issue and ready-to-fight. A ready-for-issue weapon system has been removed from its preservation status and made mechanically

and other stocks. This stockage is carried on a prescribed load list (PLL) or combat PLL. A PLL consists of unit maintenance repair parts that are demand supported, nondemand supported, and specified initial stockage for newly introduced equipment. A combat PLL consists of unit maintenance repair parts as described above, in addition to repair parts prescribed by a mandatory parts list (MPL) for equipment on hand.

While MPLs for aircraft are published in DA Pam 710-2-120, MPLs for ground equipment are published in DA Pam 710-2-117. Each unit is responsible for maintaining PLL records, submitting timely replenishment requests, and conducting inventories. All items must be on hand or on order at all times. PLL policy is found in para 2-20, AR 710-2. Manual procedures are found in Chapter 8, DA Pam 710-2-1. Automated procedures are in system user manuals.

9-3. AUTHORIZED STOCKAGE LIST

The ASL consists of those parts stocked in DS maintenance units in the division for issue to user units and to support their own DS maintenance operations. These parts are stored in and issued by the maintenance units, but stock control and accounting functions are performed by the Division Materiel Management Center.

There are several reasons for adding an item to the ASL. They are discussed in detail in AR 710-2, The DMMC, based on priorities established by the division commander, will establish the guidelines for issue, ASL design, or distribution, The DMMC is the common exit point for all requisitions and other supply documents for the division. The ASL lines are distributed among the units based on the critical combat needs of customer units. The maintenance companies of the FSB will stock repair parts that are combat essential to brigade units. The light maintenance company will maintain stocks that are combat essential to nonbrigade units and items needed to replenish the stocks of the other divisional maintenance units.

Division units submit repair parts requests to their support maintenance company. If repair parts are on hand, an issue will be made. If parts are not on hand, the request will be back ordered and a requisition passed to the COSCOM MMC. The COSCOM MMC prepares the MRO, back orders the requisitioned item, or passes the requisition to a higher source of supply, When issues are made by the CO S-COM MMC to the division, the parts are shipped to the light maintenance company. They provide the DMMC with the shipping documents received with the parts. The items are placed in a storage location (for ASL replenishment) or released to the customer if the request was a passing action. The DMMC will direct the forward movement of ASL stocks held by the light maintenance company whenever replenishment of the forward support maintenance companies' ASL is needed or to satisfy the noncritical needs of brigade customers.

9-4. REPARABLE EXCHANGE

Items authorized for repair at DS level may be supplied through a divisional RX activity. Selection of items for RX is determined by joint efforts of DISCOM supply and maintenance personnel. Items selected are those having a maintenance code of F which are currently job ordered to DS by using units on DA Form 2407/5504. Placing items on the RX list serves two useful purposes. The first is the users do not have to prepare a job order and await repair. An issue and turn-in is prepared on DA Form 2765 and the item is handcarried to the RX activity where a like item is issued. The second benefit is that only the supply activity job orders the components to DS for repair which reduces paperwork and allows DS to work load for programmed repair. Selection and stockage procedures are covered in DA Pam 710-2-2. The actual or anticipated repair frequency is at least nine times per year to place an item in RX and three times per year to retain. For aviation and missile items it is three times to place in RX and one time to retain.

Procedures for customers to obtain an item from the reparable exchange activity (RXA) are provided in DA Pam 710-2-1, The iterns are exchanged on a one-for-one basis using a DA Form 2765-1 to turn-in the unserviceable item and another DA Form 2765-1 to request the replacement.

9-5. WEAPONS SYSTEM REPLACEMENT OPERATIONS (WSRO)

WSRO is a management tool used to supply the combat commander with fully operational major weapon systems including both required equipment and trained crews. Procedures for issue of weapon systems differ from those for the issue of other Class VII items.

Two terms which are often used to describe WSRO are ready-for-issue and ready-to-fight. A ready-for-issue weapon system has been removed from its preservation status and made mechanically

- Cannibalization point operations conducted by collection, classification, and salvage units.

- Battle support cannibalization conducted by maintenance personnel IAW established procedures, usually in response to immediate tactical requirements.

- Unauthorized cannibalization performed in violation of established procedures. Controlled exchange may become unauthorized cannibalization if the unserviceable component is not replaced on, or affixed to, the donor equipment,

9-9. CANNIBALIZATION POLICY GUIDANCE

Peacetime policy guidance is contained in AR 750-1, AR 710-2, and DA Pam 710-2-2. These regulations deal with cannibalization point operations. NICP approval is required before weapon systems may be cannibalized. CONUS cannibalization points are normally set up at installations with fixed maintenance facilities. During periods of war and transition to war, a cannibalization policy must be established by the theater commander. Waivers of NICP disposition requirements must be coordinated with the NICP concerned. Corps and division commanders implement the theater policy. Sample guidance is provided in the procedures outlined below:

- During war, cannibalization point operations remain the same as during peace. When items have been authorized for disposal, maintenance personnel remove parts and components. Serviceable items are made available for issue. Unserviceable repairable items are work-ordered for repair, After the selected recoverable items are removed, the cannibalization point makes the end-item available for further supply action. Lists of end-items available for cannibalization are periodically provided to supported customers. Customers bring requisitions to the cannibalization point where issue is made on a fill or kill basis,

- Battle support cannibalization procedures are based on policy guidance from corps and TA. These procedures are designed to support maintenance operations. The goal of battle support cannibalization is to return a maximum number of weapon systems to combat units for their immediate tactical requirements. Table 9-1. illustrates a set of procedures for possible incorporation into a division cannibalization policy.

9-10. FABRICATION

When a critical part is not available through the supply system, it may sometimes be fabricated locally by support maintenance. ADA Form 2407/5504 is annotated with specifications, and a sample item, if available, is provided.

9-11. CONTROLLED EXCHANGE

Controlled exchange is the removal of serviceable parts, components, assemblies, and subassemblies from unserviceable economically repairable equipment and their immediate reuse in restoring a like item of equipment to a combat mission capable condition. Controlled exchange expedites repair and return to user in support of materiel readiness or operational effectiveness. Controlled exchange is performed by using units and support maintenance organizations.

During periods of combat or transition to war, major Army commanders may modify the conditions in which controlled exchange is performed. Controlled exchange and cannibalization will not be done on end-items which have been involved in accidents until the equipment has been formally released by the investigating officer. The document register, due-in records, and records of demands must be adjusted when controlled exchange is used.

Specific procedures for controlled exchange should be in the unit maintenance SOP. Circumstances under which controlled exchange is authorized are outlined in AR 750-1.

9-12. LOCAL PURCHASE

Local purchase, as a source of supply, maybe used to procure items required to satisfy immediate needs, The supporting supply support activity is the approving authority for local procurement. Procedures and conditions which must exist are contained in AR 710-2. Basic conditions are:

- To repair emergency equipment

- For rejected requisition items with status code CW or CP.

- When a repair part is not listed as the AMDF.

- For a requisitioned item whose expected delivery date will not satisfy requirements.
- To support contingency operations when the operation is imminent or in progress.

Table 9-1. Battle support cannibalization.

Equipment Category	Who Authorizes Cannibalization	Action
Abandon/ destroy	Division Commander	Destruction of equipment is done to prevent enemy capture and should be done only when recovery or evacuation is not feasible. The division commander has the authority to abandon/destroy equipment. He may delegate this authority to lower commands. Prior to destruction, sighting and fire control equipment and other critical items are removed and evacuated. When possible, maintenance personnel conduct cannibalization and then destroy the item.
Obvious "Code H" (Salvage)	Senior Maintenance Person	Maintenance personnel remove critical repair parts and assemblies in short supply. Parts from the item to be cannibalized are used first to conserve parts in the supply system. Following cannibalization, the item is abandoned, destroyed, or recovered/ evacuated at low priority.
Repairable at Unit Level	Tactical Unit Commander	When cannibalization of unit level parts contributes to increasing the number of weapon systems available for the immediate tactical requirement, unit maintenance personnel request authorization to cannibalize from the tactical commander concerned.
Repairable at FSB (BSA)	Tactical Unit Commander (Item meets criteria set by division commander)	When cannibalization of intermediate (DS) parts contributes to increasing the number of weapon systems for the immediate tactical requirement, intermediate (DS) maintenance personnel request authorization from the tactical commander concerned. The cannibalized item is repaired at the earliest opportunity.
Repairable at MSB (DSA)	Maintenance Control Officer	Cannibalization decisions in the DSA are coordinated by the Maintenance Control Officer with the division WSRO. Only parts needed for immediate requirements should be removed. The cannibalized item is repaired at the earliest opportunity.
Repairable at Intermediate (GS)	Maintenance Control Officer	Controlled exchange should first be used to the maximum. When possible, cannibalization decisions should be coordinated with the supporting intermediate (GS) unit. Only parts needed for immediate requirements should be removed. Following cannibalization, equipment is evacuated to intermediate (GS).

CHAPTER TEN

SAFETY RESPONSIBILITIES

10-1. COMMANDER

The unit commander is responsible for the unit safety program. Safety awareness and safe operating practices must be included in all aspects of unit operations.

10-2. CHAIN OF COMMAND

The chain of command must know the unit safety program and special safety requirements for various maintenance operations. Daily contact with workers allows supervisors to see working conditions and detect hazards. Direct and forceful action must be taken to correct unsafe conditions. Supervisors must be alert when new or unusual maintenance operations are being conducted since the possibility for an accident is increased.

10-3. INDIVIDUAL

Individuals must know and practice the special safety needs of their jobs. They must recognize the fact that the unsafe acts of others create needless hazards that should be corrected on the spot or reported to the chain of command. Active involvement and safety awareness on the part of all individuals is vital to accident prevention.

10-4. UNIT SAFETY PROGRAM

An effective unit safety program is necessary for mission completion. A maintenance mission cannot be considered a success if it involved death or injury or damage to equipment or buildings. AR 385-10 and DA Pam 385-1 outline the basic requirements for a unit safety program. Higher headquarters may give added guidance. Commanders must expand on these requirements to fully cover the safety needs of their particular operations.

10-5. STANDING OPERATING PROCEDURES

The unit safety program should be part of the unit SOP. The program should be reviewed and updated as required.

10-6. UNIT SAFETY OFFICER

A unit safety officer supervises and coordinates activities related to unit safety, keeps the commander informed, and suggests improvements to the unit program.

10-7. UNIT SAFETY COUNCIL

The commander must organize a unit safety council consisting of members of the chain of command. They meet at set times or as required to discuss better safety practices, reduction of mishaps, removal of hazards, and safety training where applicable.

10-8. SUPERVISOR MEETINGS

Supervisors must include safety in their plans and talks of daily maintenance operations. Regular safety meetings should be held in the work area. They serve to review and critique performance, draw out ideas on improving the safety program, and publicize new

or changed safety procedures. This type of meeting is notably useful prior to unit safety council meetings since it serves as a source of information and ideas which may have wider use.

10-9. FACT FINDING

When an accident occurs, it is important to get the right details for reports and possible corrective action. The following facts should be obtained in each accident:

- Name of personnel injured, identification of equipment or buildings damaged.
- Time and place of injury or damage.
- Severity and cost of injury or accident.
- Nature of the injury or accident.
- How and why of the accident.

Additional information is needed for accident prevention purposes and should include data on the unsafe act, if any, and the reason for doing it. Any mechanical or physical hazard should be named. If a tool or piece of equipment was a factor, it should be determined if the proper tool or piece of equipment was being used, if it was being used properly, and if it was defective.

10-10. CORRECTIVE ACTION

Corrective action should be based on specific facts about the accident. Near accidents should also be reported so that existing hazards and unsafe methods or conditions can be corrected. Any method or condition that threatens safety should be reported so that corrective action can be taken. If the same people are often in accidents, remedial training on accident prevention should be given and work assigned where they are less likely to be a danger to themselves or others,

10-11. ACCIDENT REPORTING

The unit safety program must set clear and specific methods for accident reporting. All accidents are reportable, however, only those accidents where death, lost-time injury, or property damage in excess of $700 are recordable, Accidents must be reported IAW AR 350-40 and local rules and directives.

10-12. EQUIPMENT OPERATOR SELECTION, TRAINING, TESTING, AND LICENSING

The unit safety program must be closely tied with equipment operator selection and training. The operator is the main cause of accidents involving equipment. Accident studies usually show that the operator did not use correct methods or was not fit to operate the equipment. The commander must strive to have an effective equipment operator qualification program and strongly enforce correct operation of equipment. As many people as possible should be trained to operate vehicles; materials handling equipment; generators; space, immersion, and duct-type heaters; and other equipment. This permits safe operation in an emergency when the assigned operator is not there. AR 600-55 contains data about motor vehicle driver selection, testing, and licensing.

10-13. SAFETY HAZARDS AND PRECAUTIONS

Maintenance operations present many hazards to maintenance personnel and others in the area. The best defense against a disabling or costly accident is knowing the safety hazards associated with each maintenance operation and using proper safeguards. The following paragraphs address the more common hazards associated with maintenance operations and some of the safeguards to be taken.

10-14. QUALITY CONTROL

The maintenance activity must ensure that equipment is safe to operate when it is returned to the user. Technical inspectors should give special attention to safety related items when doing the final inspection.

10-15. FIRE PREVENTION

This hazard should be a separate unit program. AR 420-90 outlines the details for a unit fire prevention program.

NO SMOKING signs should be posted wherever fire hazards exist. Smoking should be permitted only in approved areas. Gasoline, oil, paint, and other flammables should be stored only in approved locations and in special containers. Containers should be safety color-coded and labelled. Oxygen and acetylene bottles must be stored away from each other and from other flammables. Use of approved solvents and cleaning materials, proper containers, and good airflow in these areas will reduce the chance of fire, High pressure bottles must be securely chained to a nonmovable object.

Field operations during cold weather present an added fire hazard form heating devices. Heating devices must be in good working condition, use approved fuel, and be operated by qualified licensed people. Unit SOP should specify fireguards for tents to include having the proper fire extinguishers on hand when heating devices are in use,

Fire extinguishers and water and sand containers should be available in all maintenance areas. All personnel must be familiar with the location and operation of firefighting equipment. Frequent inspections must be made to ensure the equipment is serviceable and operable.

10-16. EQUIPMENT OPERATION

Equipment operators must know their equipment's operational limits. They must also know and abide by any special safety considerations peculiar to their equipment and obey the local traffic rules. The following cautions should be observed when working with or around equipment and vehicles:

- Ground guides must be used when moving tracked or large wheeled vehicles and equipment in the maintenance area.
- Cranes and conveyors must have controls to reduce the chance of injury or damage and should never be moved without a ground guide.
- Wrecker and recovery vehicle crews must be alert to possible accidents during recovery and lifting operations. Personnel must stand clear of equipment during recovery operations. The danger area extends to twice the length of the payed-out cable.
- Depending on the situation and circumstances, personnel should not ride in towed vehicles.
- Exercise care when operating top-heavy vehicles such as fuel tankers or when towing fuel pods.
- Slow down on slopes and rough roads.
- Never allow radio antennas to meet high tension wires.
- Always fasten tracked vehicle hatches.
- Always wear protective headgear when riding in tracked vehicles.

10-17. TRAFFIC

Any moving equipment must be regarded as a safety hazard. Vehicular traffic within maintenance areas must be controlled by speed limits and if possible by one-way flow. Other types of moving equipment, such as cranes, bulldozers, and forklifts, must have added safety controls (such as boom, blade, and fork position) set to reduce possible injury to personnel and damage to equipment.

10-18. MOVING HAZARDOUS MATERIALS

When moving hazardous materials or recovering/evacuating equipment carrying hazardous materials, special attention must be given to correct operation of the vehicle and adherence to proper markings and other safety precautions.

10-19. SPECIAL CLOTHING AND EQUIPMENT

Personnel must be familiar with the location, use, care, and inspection of special clothing or equipment they may be required to use (for example, welding mask, goggles, respirators, safety shoes, aprons, gloves, and so forth). When a job requires the use of such clothing and equipment, their use must be strictly enforced by the platoon leader or section chief. Personnel should never weld or watch welding without welding goggles or helmets. Lathe or grinding machine operators should never work without wearing goggles. Personnel working in noise-hazardous areas should never work without wearing proper hearing protection devices.

10-20. EXPLOSIVES SAFETY

Every military unit will have some type of explosives within its area of operation, such as grenades, flares, demolition items, and fuels. Proper storage facilities and limited access to these items are required. These items must be removed from retrograde materiel and vehicles entering maintenance shops.

10-21. WEAPONS SAFETY

Since some unit missions require soldiers to have their weapons loaded, commanders should establish clearing points outside the maintenance area. Prior to vehicles or weapons entering maintenance areas, all weapons should be cleared and checked to preclude accidental firing. A box or barrel filled with sand or dirt should be provided near all troop billet areas, maintenance areas, and arms storage areas into which weapons may be discharged.

10-22. NOISE SAFETY

Noise is a hazard to the physical and mental abilities of all personnel. Constant high noise levels, either in frequency or volume, have a degrading effect on personnel efficiency. Ear damage can result from loud, sharp noises such as artillery fire and high frequency chatter from machine operations. Protection from noise should be a safety consideration in all maintenance operations.

10-23. HORSEPLAY

PLATOON SERGEANTS AND SECTION CHIEFS SHOULD NOT ALLOW HORSEPLAY OR PRACTICAL JOKES AT ANY TIME; ANY SUCH ACTIONS WITHIN MAINTENANCE AREAS ARE GROUNDS FOR DISCIPLINARY ACTION.

Many accidents are the result of horseplay and practical jokes. All personnel should be told that maintenance areas are for hard work only. Platoon sergeants and section chiefs should not allow horseplay or practical jokes at any time; any such actions within maintenance areas are grounds for disciplinary action.

10-24. LASER BEAM

A laser beam is extremely dangerous to eyesight, Avoid all eye contact with a laser beam. Wear protective goggles when in an area that a laser beam is being used. Give warning when a laser beam is being used and do not point laser at personnel.

10-25. CARBON MONOXIDE

Carbon monoxide is deadly. Engines should never be operated inside buildings unless there is either good ventilation or hoses are used to carry exhaust fumes to the outside. Similar safeguards should be observed when using all stoves and heaters whether they are operated by liquid fuel, gas, coal, or wood.

10-26. CHEMICAL FLUIDS

Certain chemical fluids such as ammonia, battery acid, and cleaning compounds may present a hazard to people and equipment. These items must be properly stored in an area away from other items.

10-27. ELECTRICAL SAFETY

Electrical hazards, such as heat, shock, spark, and high frequency, must be considered. All electrical equipment must be properly grounded when used. Personnel should never wear rings, dog tags, bracelets, or watches when working near electrical devices.

10-28. RADIATION SAFETY

Radioactivity, either from nuclear weapons or peaceful use of radiation, must be monitored. Per-

sonnel must use dosimeters when required, Calibration of equipment must be current. Any item that emits radiation must be properly marked and stored.

10-29. LIFTING DEVICES

The capacity of lifting devices should never be exceeded. When appropriate, blocks or jackstands should be used to protect personnel working under equipment which is suspended by a lifting device. All lifting devices such as hoists, lifts, and booms, must be load tested and properly marked with maximum lift capacity.

10-30. TOOLS

Tools must be used for their intended purpose and be properly maintained, Use of the wrong tool for the job may result in injury to the user or damage to the tool and/or equipment. Lubricating prevents rust and corrosion. Keeping edges dressed or sharpened decreases risk of injury and increases work quality.

10-31. MISSION ORIENTED PROTECTIVE POSTURE

Working in MOPP 3 and 4 reduces visibility and increases fatigue and the potential for accidents. Safety must be stressed when doing maintenance operations in MO PP.

10-32. ARMED WEAPONS SYSTEMS

Recovery and evacuation crews should know how to disarm weapon systems. When in doubt, help should be obtained from the using unit or explosive ordnance disposal (EOD).

10-33. BOOBY TRAPS/CONTAMINATION

Abandoned equipment may be booby trapped or contaminated. Help may be obtained from the supporting EOD or chemical company.

10-34. SANITATION/HYGIENE

Inadequate sanitation facilities and poor personal hygiene increase danger from disease. Commanders must insist on high standards of cleanliness. Commanders should organize a field sanitation team and ensure, as a minimum, that the team leader is formally trained.

10-35. FOOD AND WATER

Food and water should be obtained from approved sources. If water from nonapproved sources must be used, it should be treated before use.

10-36. SHOP CLEANLINESS

Maintenance areas must be kept clean and orderly. Supervisors must ensure immediate clean up of oil spills, proper storage for used cleaning rags, control of bad components, proper tool maintenance, and dust control. Besides a clean-as-you-go policy, a scheduled **15** to **30** minute cleanup period should be established for each shift.

10-37. PAINTING

Painting should be done in a well-ventilated area, and the same safeguards as those for use of other flammables should be observed. Personnel engaged in spray painting must wear respirators.

10-38. SAFETY COLOR CODE MARKINGS AND SIGNS

AR 385-30 states need for safety color code markings of certain vehicles, shop areas, and signs.

CHAPTER ELEVEN

ENVIRONMENTAL IMPACT ON MAINTENANCE OPERATIONS

SECTION 1. INTRODUCTION

11-1. PREPARATION

Regardless of the area of employment of the division, the key functions of maintenance must be performed. Detailed discussions of operations in these environments may be found in FM 9-207, FM 20-22, FM 90-3, FM 90-5, FM 90-6, FM 90-11, TB 43-0239, and FM 90-10.

The first step in preparing for maintenance support operations is an analysis of the mission. Time, tools, skills, and repair parts (Class IX supply) are important to maintenance operations.

A detailed analysis of the area of operations to identify lines of communications will play a major part in determining how maintenance support operations will be conducted.

In hostile environments, it is probable that lines of communications will be limited. Airfields, good roads, and railroads will be the exception rather than the rule. Airdrop of supplies and equipment is an effective alternative to air-landing. Airdrop is a rapid means of delivery and makes deliveries to isolated units possible without further transhipping. Armored-infantry-mechanized (AIM) divisions have no organic airdrop support so they rely on corps units for this support.

Maintenance unit commanders must keep themselves informed at all times about user requirements and their own maintenance capabilities.

11-2. DESERT OPERATIONS

Maintenance support for desert operations requires understanding the environment. Temperatures vary according to latitude and season from over 136°F to the bitter cold of winter. In some deserts, day to night temperature fluctuation can exceed 70°F. Some species of animal and plant life have adapted successfully to desert conditions where annual rainfall may vary from zero to 10inches. Desert terrain also varies from place to place; the sole common denominator is lack of water and little, if any, vegetation. This environment can profoundly affect military operations.

Location. Desert locations are seldom close to normal lines of communication. The effects of the environment on equipment are severe, requiring increased levels of support to maintain a standard level of efficiency. Distance between units and lines of communication are long and, due to the importance of maintenance support units, are primary targets.

Security. Enemy ambushes on MSRs are a threat in desert operations. Enemy patrols may lay nuisance mines on routes, especially at critical points. Certain actions can be taken to minimize the threat to supply routes. They include--

- Route patrols before immediate use and at irregular intervals when the route is not being used. Helicopters are good for this task as they

are cost effective in personnel and time. If the route is patrolled by surface vehicles, they must have maximum protection against mine blasts. MP patrols also provide a resource for continuous monitoring of supply routes.

- Observation posts can maintain a constant presence along the route, but are relatively expensive in manpower. They should be sited so that their surveillance equipment will interlock in conditions of poor visibility.

Convoys may require armed escorts, Escort will be determined by the commander on the basis of METT. Convoys should not be scheduled at regular intervals,

Class IX Supply. There will be an increase in demand for Class IX supplies due to environmental effects on equipment and the extra maintenance effort required. Small items with high-usage rates should be held as far forward as practical. Typical high-consumption items are--

- Filter elements.
- Tires.
- Water pumps, gaskets, fan belts, water hoses, and clamps.
- All parts for ignition systems.
- Wheel and sprocket nuts and wedge bolts.
- Spare caps for all liquid containers,
- Speedometers and cables (due to dead reckoning navigation, these are critical items).
- Cleaning fluids for electronic equipment.

Mission-essential parts lists of a unit depend on its equipment, but they should be limited to only those items that would keep such equipment from performing if it failed. Heavier and larger items are carried by MSTs from the DS maintenance company, As demand varies from day to day, arrangements must be made for unexpected requirements to be moved to repair sites by air, rail, and water.

11-3. ENVIRONMENTAL EFFECTS ON EQUIPMENT

Terrain. Terrain varies from nearly flat, with high trafficability to lava beds and salt marshes with little or no trafficability. Drivers must be trained in judging terrain so that they can select the best method of overcoming the varying conditions they will encounter. Tracked vehicles are best suited for desert operations. Wheeled vehicles will go many places that tracked vehicles can go; however, their lower average speed on poor terrain may be unacceptable during some operations. Vehicles should be equipped with on-board spare fan belts, tires, and other items likely to malfunction, together with tow cables or chains (if not equipped with a winch), extra water cans, and desert camouflage nets. Air recognition panels, signal mirrors, and a tarpaulin ‘(to provide shade for crew) are very useful. Wheeled vehicles should also carry spurs, mats, or channels as appropriate to aid mobility.

The harsh environment requires a high standard of maintenance which may have to be performed well away from specialized support personnel. Operators must be fully trained in operating and maintaining their equipment. Some types of terrain can have a severe effect on suspension and transmission systems, especially those of wheeled vehicles. Tanks will often throw tracks on rocky terrain. The ASL for tires should be increased because sand temperatures of 165°F weaken rubber and reduce resistance to sharp rocks and plant spines. Items affected by mileage, such as wheels, steering, track wedge bolts and sprocket nuts, and transmission shafts, must be checked for undue wear when completing before, during, and after operation maintenance.

Heat. Vehicle cooling and lubrication systems are interdependent, and a malfunction by one will rapidly place the other under severe strain. All types of engines may overheat to some degree, leading to excessive wear and, ultimately, to leaking oil seals in the power packs. Commanders should be aware of which vehicle types are prone to overheating and ensure that extra maintenance is given to those vehicles. Oil levels must be checked frequently to ensure they are correct (too high may be as bad as too low) and that seals are not leaking. Radiators and air flow areas around engines must be kept clean and free of debris and other obstructions, and water-cooled engines should be fitted with condensers to avoid waste as steam through the overflow pipe. Cooling hoses must be kept tight (a drip a second is 7 gallons in 24 hours). Operators should not remove hood side panels from engine compartments while the engine is running as this will cause turbulence, leading to ineffective cooling.

Batteries Do Not Hold Their Charge Efficiently in Intense Heat. Battery specific gravity will have to be changed to adjust to this environment. The unit can either adjust its electrolyte to 1.200 or 1.225 specific gravity or obtain sulfuric acid with a specific gravity of 1.2085 to 1.2185. Air vents must be kept clean or vapors may build up pressure and cause the battery to explode. Voltage regulators should be set as low as practical. Stocks of dry batteries must be increased to offset high attrition rates caused by heat exposure.

Severe Heat Increases Pressure in Closed, Pressurized Systems, and Increases the Volume of Liquids. Care must be exercised to ensure that working pressure of all equipment is within safety limits and caution must be exercised when removing items, such as filler caps.

Some Items of Equipment are Fitted With Thermal Cutouts Which Open Circuit Breakers When Equipment Begins to Overheat. Overheating can be partly avoided by keeping the item in the shade and **wrap**ping it in wet cloth to maintain a lower temperature by evaporation.

Flying Time and Performance of Helicopters is Degraded as the Altitude and Heat Increase. Aircraft canopies have been known to bubble under direct heat and should be kept covered when not in use.

Ammunition Must be Kept Away From Direct Heat and Sunlight. If it can be held by bare hands, it is safe to fire. White phosphorous ammunition filler tends to liquify at temperatures over 111°F, which will cause unstable flight unless projectiles are stored in an upright position.

Wood Shrinks in a High-Temperature, Low-Humidity Environment. Equipment such as axes carried on tracked vehicles can become safety hazards as heads are likely to fly off as handles shrink.

11-4. RADIANT LIGHT

Radiant light or its heat effect may be detrimental to plastics, lubricants, pressurized gases, some chemicals, and infrared tracking and guidance systems. Items like COZ fire extinguishers, M13 decontamination and reimpregnating kits, and Redeye missiles must be kept out of constant direct sunlight. Optics may discolor in direct sunlight, so their exposure to the sun's rays should be limited.

Dust and sand are probably the greatest dangers to the efficient functioning of equipment in the desert.

Lubrication must be the correct viscosity for the temperature and kept to the absolute minimum in the case of exposed or semiexposed moving parts. Sand mixed with oil forms an abrasive paste. Lube fittings are critical items and should be checked frequently. Teflon bearings require constant inspection to ensure that the coating is not being removed. Maintenance of engines is critical due to the strong possibility of sand or dust entering the cylinders or moving parts when the equipment is stripped. It is essential to have screens against flying sand (which will also provide shade for mechanics). Surrounding ground may be soaked in used oil or covered with rocks to bind it down.

Ground handling of helicopters should be kept to a minimum in soft or sandy soil to prevent stress on the landing gear. Runups should be restricted to the minimum time and take place on rock or on oiled or wet sand if available. All apertures (pilot tubes, for example) or aircraft not in use should be covered at all times. Hovering close to the ground will lead to sand-ingestion by the engine, possible observation of dust clouds by the enemy, or disorientation of the pilot due to flying sand, particularly at night.

Dust and sand can easily cause failure of such items as cyclic microphone switches, radio and signal distribution panels, circuit breakers and collective triggers, and cause small electrical motors to burn out.

Air cleaners of every type of equipment must be examined and cleaned at frequent intervals. The **exact** interval depends on the operating conditions, but should be at least daily.

Filters may be used when refueling any type of vehicle, and the gap between the nozzle and the fuel tank filler must be kept covered. Fuel filters will require frequent cleaning. Oil filters will require replacement more often. Engine oils will require changing more often than in temperate climates. Windblown sand and grit will damage electrical wire insulation over a period of time. All cables that are likely to be damaged should be protected with tape before insulation becomes worn. Sand will also find its way into parts of items such as spaghetti cord plugs, either preventing electrical contact or making it impossible to join the plugs together. A brush, such as an old toothbrush, should be carried and used to brush out such items before they are joined.

Dust affects communication equipment such as AM RF amplifiers and radio teletype sets. The latter, especially, is prone to damage due to its oil

lubrication, so dust covers should be used whenever possible. Some receiver-transmitters have ventilating ports and channels that can get clogged with dust. These must be checked regularly and kept clean to prevent overheating.

Weapons may become clogged or missiles jammed on launching rails due to sand and dust accumulation. Sand or dust-clogged barrels can lead to inbore detonation. Muzzles must be kept covered by a thin cover so an explosive projectile can be fired through the cover without risk of explosion. Missiles on launchers must also be covered until required for USC. Working parts of weapons must have a minimum amount of lubrication. It may even be preferable to have them totally dry, as any damage caused during firing will be less than that produced by the sand/oil abrasive paste.

All optics are affected by blowing sand which will gradually degrade their performance due to small pitting and scratches. It is necessary to guard against buildup of dust on optics which may not be apparent until the low-light optical performance has severely deteriorated. It may be advisable to keep optics covered with some form of cling film until operations begin, especially if the unit is near a sandstorm. Optics must be stored in a dehydrated condition using hydroscopic material. Those in use should be kept where free air can circulate around them and should be purged at frequent intervals.

Sand and dirt can accumulate in hull bottoms of armored vehicles and, when combined with condensation or oil, can cause jamming of control linkages. Sand accumulation of the air bleeder valve can inhibit heat from escaping from the transmission and result in damage.

11-5. TEMPERATURE VARIATION

In deserts with relatively high dew levels and high humidity, overnight condensation can occur wherever surfaces, such as metal exposed to air, are cooler than the air temperature. This condensation can affect such items as optics, fuel lines, and air tanks. Fuel lines should be drained night and morning, and optics must be cleaned frequently. Weapons, even if not lubricated, will accumulate sand and dirt due to condensation, another reason for daily cleaning.

Air and fluids expand and contract according to temperature. If tires are inflated to correct pressure during the night, they may burst during the day. If fuel tanks are filled to the brim at night, they will overflow as temperatures rise. Air pressure must be checked when equipment is operating at efficient working temperature and fuel tanks must be filled to their correct capacity as defined in the appropriate technical manual.

11-6. STATIC ELECTRICITY

Static electricity is common in the desert. It is caused by atmospheric conditions coupled with an inability to ground out due to dry terrain. It is particularly likely with aircraft or vehicles having no conductor contact with the soil. The difference of electrical potential between separate materials may cause a spark when contact is made, and if inflammable gases are present, they may explode or cause a fire.

A grounding circuit must be established between fuel tankers and vehicles being refueled and maintained before and during refueling.

11-7. WINDS

The velocity of desert winds can be destructive to large and relatively light material, such as aircraft, tentage, and antenna systems. To minimize wind damage, materiel should be given terrain protection and should be firmly picketed to the ground.

11-8. MAINTENANCE

General guidelines for desert repair of equipment are--

- Repair only that necessary to make the equipment combat effective (MEMO).
- Recover and then evacuate to the nearest reasonable secure site, followed by on-the-spot repair.

An SOP for recovery and repair must be established before or immediately on arrival in the theater. The SOP should include--

- Guidelines for crew level recovery and expedient repair.
- Recovery by unit maintenance.
- Recovery by DS maintenance.
- Priorities for recovery by vehicle types.

- Limitations on field expedients (for example, the distance/time over which one tank is allowed to tow another, considering the heat buildup in transmissions in this environment).

- Security and guides for recovery teams.

The recovery plan of an operation should include locations of collecting points for equipment that cannot be repaired farther forward. These points must be located where they can be reached by HETs, which may involve a longer tow by an armored recovery vehicle than would be normal in a European environment. The collection point should cover a large area to allow for dispersion of supporting units and weapons systems. An MST from the FWD maintenance unit will normally be located at the collection point to determine disposition of the equipment. Equipment that is authorized for disposal may be cannibalized to support the repair of like vehicles. When considering recovery in the desert, special attention must be paid to ground anchoring equipment since natural anchoring material is scarce (see FM 20-22).

11-9. COLD WEATHER OPERATIONS

One of the major problems for units operating in cold weather conditions is the lack of personnel with adequate training in cold weather operations and maintenance. If troops stationed in temperate climates must move to cold climates and perform their mission, cold weather training is of the utmost importance. Much time and energy in cold weather areas is expended in self-preservation, which reduces the efficiency of personnel in the operation and maintenance of materiel. Maintenance personnel must learn how to live and work in cold regions.

Location. Operation of materiel in temperatures to -10°F presents few problems. Conditions are similar to those in the northern portions of CONUS during the winter. From -10°F to -40°F, operations become difficult. Figure 11-1 shows how levels of difficulty increase as temperatures drop.

Proper training will prevent failures of materiel and injuries to operating personnel. When the temperature is below -40°F, operations become increasingly difficult. At temperatures near -65°F, the maximum efforts of well-trained personnel are required to perform even a simple task with completely winterized materiel.

Security. Enemy ambushes are always a threat in snow-covered terrain. Camouflage can be a basic weapon to help defeat the enemy, since units must furnish their own security, reconnaissance, and surveillance, In the absence of issued camouflage

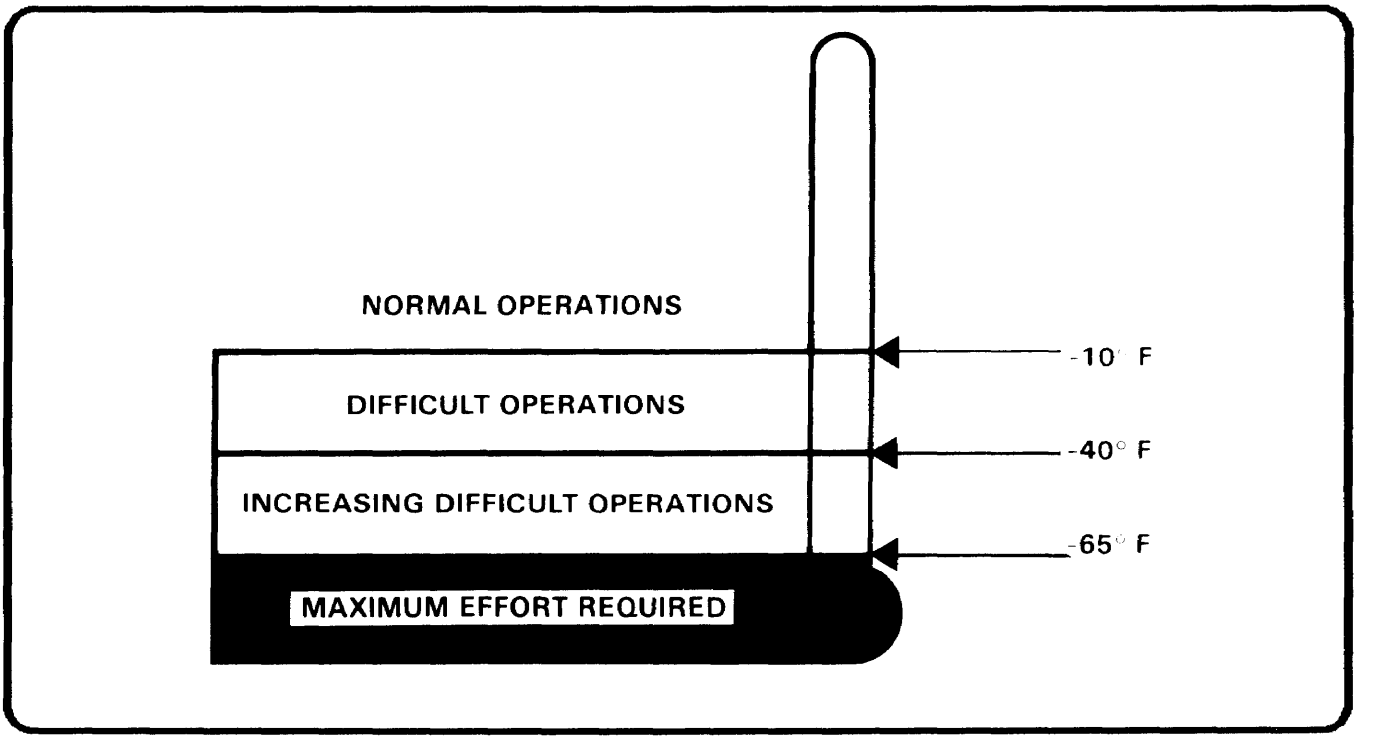

Figure 11-1. Levels of difficulty v.s. temperature ranges,

uniforms, the soldier may improvise a camouflage suit, adapting its color and pattern to the terrain background.

For use in snow-covered terrain, there is a white garment designed to blend with a white or mottled white and black background. The snowsuit does not conceal the small patches of shadow that surround a human figure, but this is not necessary since snow country usually contains numerous dark spots and shadows. If certain snow areas are all white with absolutely no shadows, use is made of defiles and natural folds in the ground.

Class IX Supply. The effect of cold weather on Class IX supply makes handling and storage of materials of prime importance. Supplies are delivered as far forward as weather, terrain, and tactical situation permit. However, supply requirements will vary significantly from those encountered in temperate climates.

Metals become brittle in extremely low temperatures, so parts cannot withstand the shock loads that they sustain at higher temperatures.

Extreme care must be taken in handling rubber-covered cables at low temperatures. If the rubber jackets become hard, the cables must be protected from shock loads and bending to prevent short circuits caused by breaks in the covering. Neoprene jackets on cables become very brittle and break readily at low temperatures.

Tires become rigid in cold, causing flat spots on portions that come into contact with the ground during shutdown periods. At extreme low temperatures, sidewalls become brittle and crack.

Plastics expand and contract much more than metal or glass. Any parts or materials made of plastic must be handled carefully.

Glass, porcelain, and other ceramics should perform normally at low temperatures if handled carefully. Cracking may result if heat is applied directly to cold windshields or vehicle glass,

Fabrics retain their flexibility even at extremely low temperatures provided they are kept dry.

Maintenance. Personnel must be aware of the importance of maintenance, especially PMCS. Maintenance of mechanical equipment is exceptionally difficult during cold weather. Shop maintenance cannot be completed with normal speed because the equipment must be allowed to warm up before maintenance personnel can make repairs. Personnel need additional time to perform routine tasks. This time lag cannot be overemphasized and must be included in all planning. Personnel efficiency is reduced by the bulky clothing that must be worn at all times, The resulting loss of the sense of touch further reduces efficiency. Even the most routine operations, such as handling latches or opening engine enclosures, become frustrating and time-consuming when they are performed with protected hands. At temperatures below -20°F, maintenance requires up to five times the normal amount of time. Complete winterization, diligent maintenance, and well-trained crews are the keys to efficient cold weather operations (See FM 9-207) .

Requirements affecting maintenance planning and preparation before a cold weather operation should be undertaken as follows:

- Shelter for materiel requiring maintenance.
- Proper clothing and tools for maintenance personnel.
- Ground cover (plywood or canvas) for personnel to lay on when under vehicles.
- Adequate portable heaters.
- Suitable methods to store and issue antifreeze materials, fuels, hydraulic fluids, and lubricants.
- Sufficient lighting equipment.
- Supply of repair parts for equipment.
- Sufficient equipment for removal of snow and ice.

WARNING

Care must be taken for proper ventilation to avoid the danger of carbon monoxide poisoning caused by the operation of engines or from contaminated hot air from defective heaters. Do not use heaters that produce contaminated hot air in buildings or maintenance tents where personnel are present.

Buildings and Shelters. Heated buildings or shelters are needed for cold weather maintenance. Main-

tenance of many components requires careful and precise servicing. Without use of heaters, the increase in maintenance man-hours will be from 25 to 200 percent above normal requirements.

When buildings are not available, maintenance tents are a temporary expedient. When possible, wooden flooring should be laid inside all tents. Tents should be heated by portable duct heaters or tent stoves.

WARNING

When vehicles, generators, and POL containers are brought into warm storage from the cold, the fuel tanks/container should only be filled three-quarters full, If this procedure is not followed, the expansion of the cold POL products in the fuel containers could cause spillage and a serious fire hazard.

WHEN BUILDINGS ARE NOT AVAILABLE, MAINTENANCE TENTS ARE A TEMPORARY EXPEDIENT. WHEN POSSIBLE, WOODEN FLOORING SHOULD BE LAID INSIDE ALL TENTS. TENTS SHOULD BE HEATED BY PORTABLE DUCTS OR TENT STOVES.

In the absence of buildings or maintenance tents, tarpaulins may be used as a field expedient to create overhead shelter and wind breaks. The tarpaulin can be supported on a framework of poles erected around the vehicle. Parachutes can also be used as temporary shelters. The parachute should be deployed over the vehicle, securely staked down at the bottom, and then inflated by the air from a portable duct heater. If parachute shelters are used, extreme care should be taken to avoid carbon monoxide poisoning.

WARNING

Personnel must **be constantly on the alert to detect vehicle deficiencies that expose personnel to carbon monoxide poisoning. Passenger and crew compartments of wheeled and tracked carriers must be inspected and tested at regular intervals to detect any signs of air contamination from exhaust gases caused by leaking gaskets, improper exhaust installation, cracked exhaust pipes, defective personnel heaters, and auxiliary generators.**

Lighting Equipment. Sufficient equipment must be available to furnish lights for maintenance services. Lights with ample cable extensions, attachment plugs, connectors, and spare bulbs are essential.

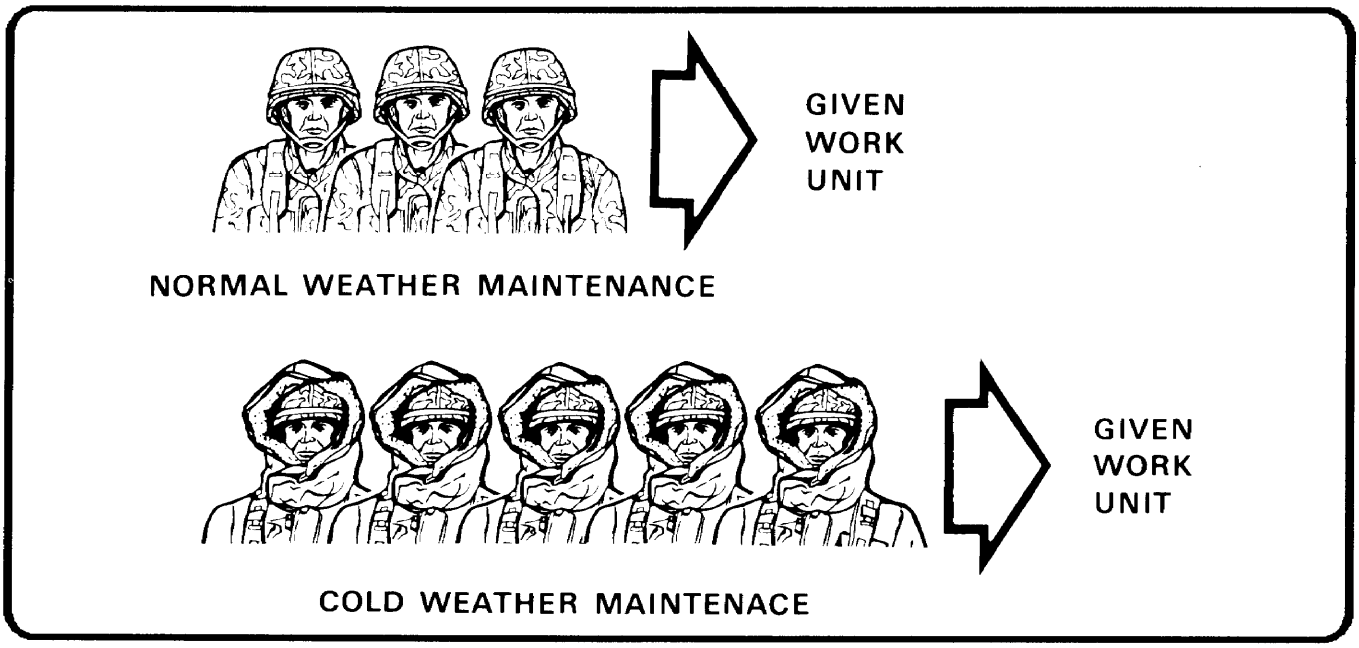

Figure 11-2. Normal v.s. cold weather maintenance.

Maintenance Personnel, Tools, and Equipment. An increase in the number of mechanics will be required to maintain equipment in cold weather operations. As a minimum, a highly organized, more intensive, effort is required of personnel on hand. It must be remembered that the amount of work performed under cold conditions is considerably less than work accomplished in moderate temperatures (see Fig 11-2).

An additional supply of battery chargers must be available to meet the heavy requirements for battery maintenance in subzero temperatures, Hydrometers and testers must be on hand to check the state of charge of batteries. The tools provided in the various tool chests are adequate for maintenance at subzero temperatures.

Gloves may become saturated with fluids when performing maintenance on fuel systems and lubricating cooling systems. This reduces the insulating value of the gloves and may result in cold injury to personnel. Personnel should, therefore, carry extra gloves when performing maintenance.

Personnel should avoid leaning on cold-soaked equipment or kneeling or lying on the ground. Rapid body cooling caused by heat transfer to the equipment or ground may result in cold injury. Some sort of insulation, such as fiber packing material, corrugated cardboard, rags, or tarpaulins, should be placed between the mechanic/repairer and the equipment.

When performing maintenance under arctic winter conditions, a box or a pan should be used to hold small parts. A tarpaulin should be placed under the vehicle to catch parts which may be dropped to prevent them from being lost in the snow.

11-10. JUNGLE OPERATIONS

Maintenance elements in a jungle environment retain the same basic mission and capabilities as in other environments. However, they must make adjustments due to terrain, weather, and vegetation.

Location. Jungle operations subject personnel and equipment to effects not found in other environments. Trafficability and security problems often affect maintenance support elements as much as maneuver forces.

The lack of an extensive all-weather transportation network in many jungle areas makes the missions of support units more difficult. Transportation difficulties may dictate that maneuver units be resupplied by air, pack animals, or human portage.

Security. Jungle combat operations are characterized by ambushes and infiltration. The security threat caused by infiltrators will require that lines of communication be patrolled frequently and convoys be escorted. Therefore, maintenance support must be performed as far forward as the tactical situation

permits. This improves response time, reduces road movement, and allows the maintenance support elements to take advantage of the security offered by combat units,

Class IX Supply. Repair parts that deteriorate or wear out faster in the jungle environment must be identified. The PLL must reflect the increased turnover of these parts,

Maintenance. Maintenance elements in the jungle function essentially the same as in other operations. The high humidity and temperature in jungle areas will increase maintenance requirements. PM on any items affected by moisture and heat is extremely important. Emphasis must be placed on on-site maintenance and the use of aircraft to transport MSTs and repair parts to unit level. The need for responsive maintenance support means the number of repair parts for immediate exchange must be increased.

Transportation. Maintenance elements should consider all types of transportation. Surface transportation facilities are poor in most jungle areas and cannot handle heavy military traffic without extensive improvements. An air line of communication can eliminate many of the problems associated with surface movement.

Human portage is a basic means of moving supplies and equipment in jungle operations, At best, this method is slow, laborious, and inefficient.

Wheeled vehicles are normally restricted to roads and wider trails and even these may prove impassable during heavy rains. Sometimes repair parts must be transported by transloading from wheeled to tracked vehicles. For example, large wheeled vehicles move the supplies as far forward as possible, where they are transloaded to tracked vehicles which move them cross-country. In rugged terrain, the supplies may have to be further transloaded to pack animals or native supply bearers.

Fixed-wing transport aircraft can usually operate at greater distances without refueling than cargo helicopters. However, use of fixed-wing aircraft to land supplies requires more landing strips than may be present. Construction and maintenance of airfields in jungles is a difficult engineering task, but a savanna may be large enough and firm enough to use as an airstrip.

Airdrop of supplies is an alternative to airlanding. Airdrop by parachute is a rapid means of delivery and makes deliveries to isolated units possible without further transloading. Disadvantages include the dispersion of supplies and the possibility of lost cargo in the jungle canopy, vulnerability to local enemy air defense, and requirements for at least local friendly air superiority.

11-11. MOUNTAIN OPERATIONS

Historically, the focal point of mountain operations has been the battle to control the heights. Changes in weaponry and equipment have not altered this fact. In all but the most extreme conditions of terrain and weather, infantry, with its light equipment and mobility, remains the basic maneuver force in the mountains. With proper equipment and training, it is ideally suited for fighting the close in battle commonly associated with mountain warfare. Mechanized infantry can also enter the mountain battle, but it must be prepared to dismount and conduct operations on foot. Conditions that have a significant effect on maintenance operations will be encountered in mountains. Because of the severity of the environment, maintenance support in mountainous areas can be somewhat difficult.

Location. Because of terrain constraints, it may be necessary to disperse support units over a wide area. Dispersion reduces vulnerability of maintenance units; however, it may cause problems with commands, control, and local security. Maintenance units will be high-priority targets and must have adequate protection against ground and air attack to ensure continuous operations. Maintenance units must be located as far forward as possible.

Security. Mountains provide excellent opportunities for ambushes and attacks on vehicle traffic on MSRs. Enemy units can be air dropped or airlanded on key terrain that dominates supply routes. Maintenance units must be alert for enemy infiltration detachments that may seize important road junctions to isolate combat units from their maintenance support. Route patrols and observation posts are required to secure MSRs.

Class IX Supply. In mountain operations, rugged terrain and climatic extremes cause repair parts consumption to increase. Movement of repair parts should be expedited into and within the combat area. Parts with high usage rates should be stocked at both DSA and BSA maintenance units. Typical high-consumption repair parts are--

- Tires.
- Tie rods.

- Transmissions.
- Brake shoes.
- Tracks and pads.
- Final drives.
- Winch parts.

Isolated operations will require an increased repair parts stockage in each category; however, stockage lists should contain only those repair parts that are combat essential and are required for the mission performance of a particular piece of equipment.

Maintenance. Fixing equipment as far forward as possible is extremely important in mountain operations. Vehicle crews and maintenance personnel must be trained to evaluate accurately the damage to their equipment.

Repair should be accomplished by maintenance teams from the unit maintenance element or MSTs from the DS company.

Evacuation of equipment will be very difficult. When evacuation is required, equipment should be moved only as far rearward as the point where repairs can be made, frequently the combat trains area. Cannibalization of nonreparable equipment may also be required to maintain the maximum operational ready rate.

Transportation. Although vehicles are used to move a large share of repair parts forward, they are not always able to reach deployed units. Animals, obtained locally, or individual soldiers must often move repair parts from roads to unit positions. Whenever possible, vehicles should be used to move heavy and bulky items or repair parts.

When weather permits, helicopters can be used to move repair parts from the DSA or the brigade trains area directly to forward units. Their use speeds resupply operations and reduces multiple handling. Helicopters are good for emergency resupply and movement of high-priority supplies; they should be used whenever possible. Resupply by US Air Force aircraft is another method,

11-12. URBANIZED TERRAIN

The characteristics of the urban battlefield and the nature of urban combat do not cause significant changes in maintenance doctrine or organizations. However, they do impact on how maintenance is provided. Urbanized regions normally contain a well-developed distribution system; major portions of this network are highways, rail lines, airfields, manufacturing plants, and storage areas, Built-up areas will frequently provide suitable locations for deployment of maintenance elements. Such areas offer excellent cover and concealment and may contain easily adaptable maintenance and storage facilities. At the same time, rubbled or damaged built-up areas may be obstacles along lines of communication which are vital to the effective functioning of maintenance elements. The close and continuous nature of urban combat may modify specific maintenance and repair parts requirements and capabilities as the dominant role of the division shifts from armor and mechanized formations to infantry supported by other arms.

Location. Because of the tactical situation, maintenance units may support units in, or provide support from, a built-up area. When using built-up areas, protection and physical security become important considerations. Supplies and equipment must be protected from both enemy attack and theft. Refugees may seriously impede or block movement ***over*** routes required by MSTs or movement of equipment to MCPs. Maintenance units may take advantage of hard stands, overhead lift, installed communication systems, and maintenance facilities existing in their areas of responsibility.

Security. Buildings provide excellent opportunities for snipers and thieves to attack maintenance units. Maintenance units must be alert for enemy infiltration detachments that may move among the civilian population. Maintenance shop areas should be blocked off with patrols and observation posts, as required to secure the area.

Class IX Supply. In urban terrain operations, vehicle repair parts usage may decrease as units dismount. Consumption of repair parts for small arms and engineer equipment may subsequently rise. Maintenance personnel will have to adjust to the changing environment.

Concentrated operations will allow centralized control of repair parts in urban operations. MSTs may operate from the base company location reducing the stockage of repair parts forward.

Maintenance. Fixing equipment on site is extremely important in urbanized operations, Vehicle areas and unit maintenance personnel must be trained to evaluate accurately the damage to their equipment.

Evacuation of equipment will be very difficult. When evacuation is required, equipment should be moved only as far rearward as the point where repairs can be made. Considerations of the maintenance site must be given to--

- Sufficient area around equipment for lift/recovery vehicles to operate in.
- Use of a nearby maintenance shop or garage.
- Security,

Transportation. Although wheeled vehicles are used to move many repair parts forward, they are not always able to reach the unserviceable equipment due to rubble and blocked roads. Tracked vehicles may often move repair parts forward over the obstruction. Individuals and soldiers must often move repair parts from clear areas to equipment locations.

APPENDIX A

BATTLE SUPPORT SCENARIO

The following scenario illustrates an example of maintenance support drawn from both divisional and nondivisional assets to a forward area, provided in a divisional area.

The division has been participating in a corps offensive operation. After heavy fighting, it has secured the division objective and expects to be ordered to resume the attack in 24 hours. One of the 2d Brigade's armor battalions, the 9/99th Armor, has reported loss of 24 of its 58 tanks during the assault on the final objective. The remainder of the division has also incurred heavy equipment losses as well as maintenance personnel losses in the forward support companies. The following events take place:

The 9/99th reports its losses to the chain of command. The BMO provides available information to the forward support maintenance company and requests assistance. The BMO takes stock of his personnel and equipment resources. The plan is to make an initial assessment of the overall damage so that when support personnel arrive an overall concept of operation can be quickly developed. Based on this initial information, the BMO plans to initiate on-site repair of the least damaged equipment. The BMO also plans to use self-recovery techniques and the battalion's recovery vehicles to begin recovery of the damaged items to the battalion UMCP or the BSA. Based on the initial damage reports and a review of the current tactical situation, the BMO decides to set up a new battalion UMCP at a more centralized location. The BMO selects the company trains location of one of the tank companies, organizes and briefs his MST on the plan of action, and dispatches them with instructions to report to the new UMCP location.

The forward support company commander reviews the requirement and resources. Most of the tank maintenance personnel are deployed with MSTs in the forward areas. While losses in the other brigade battalions are not as heavy as those of the 9/99th, the damage will require continued support. From the SOO, the company commander learns that a maximum number of tanks must be returned to operation within the next 24 hours to support continuation of the offensive, The company commander considers the situation and consults with the maintenance control officer (MCO). They agree that assistance must be requested. They also develop a plan of action for the work to be performed. The damage must first be accurately assessed. A plan can then be developed for each piece of equipment. The initial effort will be concentrated on the items which can be quickly repaired on site. The main effort will then move the UMCP. In order to repair the maximum number of tanks, the established time criteria may have to be modified for this operation. The work load from the UMCP will have to be distributed throughout the division to make maximum use of total resources. They decide to put the DS automotive maintenance technician in charge of the operation at the UMCP.

For assistance, they will also send the armament technician; inspectors from the inspection section; and the remaining available tank automotive, turret, and fire control personnel. When assistance arrives from the DSA, personnel will be directed to where

they can be used most effectively. The commander and MCO decide that items requiring lengthy repair should be identified early and recovered to the BSA for repair or evacuation to the DSA. Evacuation will have to be by HET since all recovery vehicles will be busy in the forward area.

The forward support company commander discusses the concept with the battalion SOO. The SOO agrees to request assistance from the Materiel Office in the DMMC. The Materiel Office tasks the SOO in the MSB to augment forward support company and authorizes direct coordination between the MSB SOO and the FSB SOO.

The materiel officer in the DMMC foresees a need for backup assistance from the corps support command (COSCOM) to prepare for continuation of the offensive and further estimates that it will take about 3 hours for DSA MSTs to be organized and equipment to arrive at the forward location. Also, the Materiel Officer feels that assistance from corps will take approximately 12 hours to arrive. Based on these estimates, the SOO and the company commander review their plan of action and the maintenance time criteria. It appears that the maximum immediate benefit can be obtained by concentrating the division resources at the UMCP and by evacuating time consuming jobs to the DSA to await corps support personnel. Extending maintenance time criteria to 12 hours at the UMCP and evacuating more extensively damaged items to the DSA appears to maximize the available time and resources. The SOO explains that HETs will be used to bring damaged equipment back to the DSA and that equipment identified as needing more than 12 hours to repair should be recovered directly to the BSA to await the HETs. While awaiting transportation, these items may be used as a source of repair parts through controlled exchange or cannibalization. The SOO instructs the company commander to initiate the plan. In the meantime, the SOO will brief the battalion commander, request assistance from the corps, clear the modification of the time criteria, and coordinate for MSTs and HETs from the DSA.

The forward support company commander briefs the MCO on the arrangements coordinated with the SOO, The automotive technician takes charge of the forward maintenance operation in support of the 9/99th. Support is to be organized into a single MST under the automotive maintenance technician's supervision.

At the UMCP, the number of tanks damaged was higher than initially reported. Twenty-eight tanks were damaged by the enemy action. Battalion personnel, in coordination with the MST in the area, have conducted a hasty BDA. The initial assessment is that here are five catastrophic losses with no chance of repair. Thirteen may be fixed in the battalion area within the revised time criteria if parts and personnel are available. The remaining ten must be evacuated to the DSA. The senior member from the FSB MST explains that after the initial hasty assessment the senior member identified several prime candidates for battalion maintenance team repair, The BMO reports that battalion personnel have repaired three of the damaged tanks, but that further repairs will require DS level assistance.

The BMO has set up a maintenance control center, with a map and a status board, identifying the location of the damaged equipment and remarks on the damage and status of repair. The BMO has displayed the availability and status of the battalion's recovery equipment on another status board which is being used to control recovery operations.

The MST leader notes that one of the damaged tanks can be repaired by replacing the power pack and another by replacing the transmission. Both types of serviceable assemblies were brought forward from the BSA. He makes the power pack available to the BMO and dispatches two repairers to work with battalion personnel in changing the transmission. The MST leader takes stock of the inspection sheets already completed by support personnel and organizes inspectors to complete the BDA. The MST leader begins to develop an action plan for each piece of equipment. A sampling of the inspection sheets provided by the BMO reads:

"Tank MIA 1 USA Number 9B38477. Location: Tank is total loss. Round through turret. Turret and crew compartment burned and complete loss. Some fire damage and loss of cables in engine compartment. Some engine components may be serviceable. Track and suspension system OK."

"Tank, MIA 1, USA Number 9B84174. Location: Repairable at GS. Round through right rear final drive mounting bracket. May be other damaged assemblies in engine compartment. Turret undamaged. "

The MST leader establishes a work control log and records the identity and condition of the equipment as inspection reports are received from the MST. When the BDA is complete, the MST leader uses the triage process to identify disposition of each item and to organize the repair effort. In addition to the three tanks repaired by battalion mechanics,

MST personnel working with battalion mechanics were able to repair four more on site. Eight tanks have been identified for repair at the UMCP and eight more for evacuation to the DSA. Of the five catastrophic losses, three were determined to contain serviceable components and were designated for recovery to the BSA. As unserviceable major assemblies are identified, the MST leader reports repair parts requirements to the forward support company. MCO will fill the requirement or relay it to the battalion SOO. The main effort now shifts to recovery of vehicles to the UMCP and BSA.

The personnel from the heavy maintenance company arrive as unserviceable assets begin to accumulate at the UMCP. They bring with them additional serviceable assemblies. The MST leader organizes their effort and maintains a record of their progress. Repaired vehicles are promptly reported to the BMO who further notifies the weapons system manager (WSM),

The MST leader monitors the availability of HETs to support evacuation from the DSA. In coordination with the BMO, the MST leader controls the recovery effort to keep the personnel at the UMCP and the HETs at the BSA gainfully occupied.

The battalion SOO accomplishes the actions previously identified. The SOO briefs the battalion commander on the support plan and also requests from the DMMC extension of the maintenance time criteria at the UMCP to 12 hours and a 20-man tank MST from the COSCOM. Following coordination with the G4, the DMMC approves extension of the time criteria and informs the SOO that the requested MST should arrive in approximately 8 hours. The SOO informs the heavy maintenance company commander of the assistance being provided, and that the corps MST will be under the company commander's operational control. In the meantime, the materiel officer requests that the heavy maintenance company concentrate on evacuating the unserviceable tanks from the BSA to the DSA in preparation for the arrival of the corps MST.

The MST leader reviews the situation at the UMCP toward the end of the time criteria period. Five tanks were repaired on site in a joint battalion and maintenance company effort, Initial recovery concentrated on the eight tanks identified for repair at the UMCP. Also, the three catastrophically damaged tanks that still contained serviceable components were recovered to the UMCP for cannibalization. Following recovery of the eleven tanks to the UMCP, the effort switched to verifying the BDA done in the field. The MST leader discovers that due to lack of qualified personnel, the fire control component damage in the initial assessment had been seriously understated. The MST leader details one of his most experienced repairers to conduct a reinspection. The MST leader also alerts the MCO in the BSA that there will be a need for fire control components from the tanks scheduled for evacuation to the DSA. At the end of ten hours, six more tanks have been repaired at the UMCP. Of the remaining two repairable tanks, one is discovered to need GS maintenance. Repair requirements on the other have been reduced to an elusive hydraulics problem that cannot be identified. The BMO advises the MST leader that he plans to close out the forward UMCP location at the end of the time criteria period. The MST leader consequently directs recovery of the remaining unserviceable tanks to the BSA. The MST leader organizes a stay-behind team to remain after the close of the UMCP to remove the remaining serviceable components from the three catastrophically damaged tanks.

The evacuation effort from the BSA has been proceeding well. The heavy maintenance company commander has made three HETs available to support the evacuation. Evacuation was initially slowed by the MST requirement for additional fire control components. The MCO used this opportunity to evacuate some of the more heavily damaged weapon systems from the other brigade units. The BSA also alerted the MCO of the heavy maintenance company to expect a heavy requirement for fire control components and suggested that expediting action by the DMMC may be in order. At the end of the 12-hour period, the only 9/99th tank remaining at the BSA is the tank with the hydraulics problem. The work load from other units, however, has accumulated and, as the MST prepares to return from the UMCP location, the MCO is planning how best to use them against the new requirements.

At the DSA, the heavy maintenance company MCO has been preparing for the arrival of the COSCOM MST and the return of unit personnel from the forward area. The MCO's effort concentrates on verifying the BDA made at the forward location and on providing repair parts needed for each vehicle. An early recognition of a potential problem in the fire control component area was a result of the forward support MCO's call. Having checked balances on hand at the reparable exchange (RX) point and found them inadequate, the MSB SOO provided a list of anticipated requirements to the division Class IX officer and requested expediting action. The

Class IX officer checked the assets of the other forward support companies and, finding critical shortages there also, added their requirements to the list and requested expediting action from the COSCOM materiel management center (CMMC).

The COSCOM MST arrived 10 hours after the initial request. Team members were briefed by the heavy maintenance company commander and the MCO and organized into crews to work on the disabled tanks. The effort of the heavy maintenance company and the COSCOM MST was not dedicated only in support of the 9/99th, As explained by the company commander, the overall goal of the support was to repair the maximum number of damaged tanks within the next 14 hours. Following the closing of the 9/99th UMCP at the forward location, the COSCOM team is augmented by the company personnel returning from the forward location.

Within an hour of the initial request for assistance, the DMMC informs the MSB SOO that COSCOM assets are available for about 80 percent of the requested fire control components. The Class IX officer requests that a unit pickup be coordinated with the COSCOM MMC. The Class IX officer further explains that there will be unserviceable to exchange for only a portion of the requirement and that some of the components will have to be provided as an issue rather than exchange, The Class IX officer then contacts the division MMC and requests helicopter support for the unit pickup. Having made these arrangements, the RX section in the light maintenance company is tasked to obtain the unserviceable from the heavy maintenance company and to effect the unit pickup.

The serviceable assets are provided to the heavy maintenance company approximately two hours after arrival of the COSCOM MST.

At the end of the 24-hour period, the SOO summarizes the maintenance effort for the battalion commander. Of the 28 tanks initially damaged in the 9/99th, 18 have been returned to operation. Five reparable tanks remain at the heavy maintenance company, of which four will have to be evacuated to COSCOM maintenance activities due to the extensive damage. Also, the COSCOM MST has assisted in repair of six tanks belonging to other divisional units.

GLOSSARY

ACRONYMS AND ABBREVIATIONS

ACE . . . . . *..allied command Europe*

ACL . . . . . *..area calibration laboratory*

ACofS . . . . . *..assistant chief of staff*

ACRC . . . . . *..area calibration and repair center*

ADA . . . . . *..air defense artillery*

ADC . . . . . *..area damage control*

ADMN/LOG . . . . . *.administrative/logistics*

AMMO . . . . . *assistant division materiel management officer*

ADP . . . . . *..automatic data processing*

AG . . . . . *..adjutant general*

AHC . . . . . *..assault helicopter company*

AIM . . . . . *..armored-infantry-mechanized*

ALO . . . . . *..authorized level of organization*

ALOC . . . . . *..air lines of communication*

AMC . . . . . *..U. S. Army Materiel Command*

AMCO . . . . . *aviation maintenance company*

AMDF . . . . . *..Army Master Data File*

AMSF . . . . . *..area maintenance supply facility*

ANN . . . . . *armored maintenance vehicle*

AOAP . . . . . *..Army oil analysis program*

APOD . . . . . *..aerial port of debarkation*

APOE . . . . . *..aerial port of embarkation*

ART . . . . . *assessment and recovery team*

ASB . . . . . *..aviation support battalion*

ASL . . . . . *..authorized stockage list*

ASP . . . . . *..ammunition supply point*

ATE . . . . . *..automated test equipment*

ATST . . . . . *..area TMDE support teams*

AVCRAD . . . . . *..aviation classification repair activity depot*

AVIM . . . . . *..aviation intermediate maintenance*

AVUM . . . . . *..aviation unit maintenance*

BDA . . . . . *..battle damage assessment*

BDAR . . . . . *..battle damage assessment and repair*

BDR . . . . . *..battle damage repair*

BII . . . . . *..basic issue items*

BITE . . . . . *..built-in test equipment*

BMO . . . . . *..battalion motor officer*

BSA . . . . . *.. brigade support area*

CAB . . . . . *..combat aviation brigade*

C&RS . . . . . *calibration and repair support*

CBAA . . . . . *cavalry brigade (air attack)*

CE . . . . . *..communications-electronics*

CEO. . . . . *..commnications -electronics officer*

CEWI. . . . . *..combat-electronic warfare and intelligence*

CMMC. . . . . *.. COSCOM materiel management center*

COMMZ. . . . . *..communications zone*

COMSEC . . . . . *..communications security*

CONUS .. . . . . *..continental United States*

COSCOM. . . . . *..corps support command*

CP. . . . . *..command post*

CS. . . . . *..combat support*

CSA. . . . . *..corps support area*

CSAB. . . . . *..combat support aviation battalion*

CSAC. . . . . *..combat support aviation company*

CSS . . . . . *..combat service support*

DA., ... *..Department of the Army*

DAAS. . . . . *.Defense Automatic Addressing System*

DAO. . . . . *..division ammunition officer*

DART. . . . . *.damage assessment and recovery team*

DCSLOG. . . . . *.Deputy Chief of Staff for Logistics*

Due. . . . . *division data center*

decon. . . . . *..decontaminate*

DISCOM . . . . . *..division support command*

DLOGS. . . . . *division logistics system*

DMMC. . . . . *..division materiel management center*

DOD. . . . . *.. Department of Defense*

DS. . . . . *..direct support*

DSA. . . . . *..division support area*

DSU. . . . . *..direct support unit*

DTO. . . . . *division transportation officer*

EAC. . . . . *..echelons above corps*

ECC. . . . . *..equipment category code*

EIR. . . . . *..equipment improvement recommendation*

ELSEC. . . . . *..electronic security*

EMP. . . . . *..electromagnetic pulse*

EOD .. . . . . *..explosive ordnance disposal*

EW.....*electronic warfare*

FAAR. . . . . *..forward area alerting warfare*

FASCO . . . . . *..forward area support coordinator*

FAST... . . . . *..forward area support team*

FEBA. . . . . *forward edge of battle area*

FLOT. . . . . *..forward line of own troops*

FSB. . . . . *..forward support battalion*

FWT . . . . . *..fair wear and tear*

GS . . . . . *..general support*

HBDR. . . . . *..helicopter battle damage repair*

HET. . . . . *.heavy-equipment transporter*

HHC . . . . . *..headquarters and headquarters company*

HQDA. . . . . *..Headquarters Department of the Army*

IAW. . . . . *..in accordance with*

IMRF ., ... *..instrument master reference file*

INSCOM . . . . . *..US Army Intelligence and Security Command*

LCMS. . . . . *..land combat missile system*

Less. . . . . *..land combat support system*

LIF. . . . . *..logistics intelligence file*

LOC. . . . . *..logistics operation center*

LRP. . . . . *..logistic release point*

LRU . . . . . *..line replacement unit*

MAC. . . . . *..maintenance allocation chart*

MACOM. . . . . *..major Army command*

MAD. . . . . *..maintenance activity designator*

MAIT.... *maintenance assistance and instruction team*

MATO. . . . . *..materiel officer*

MBA... . . . . *..main battle officer*

MCC . . . . . *..movement control center*

MCO. . . . . *..maintenance control officer*

MCP. . . . . *..maintenance collection point*

MCS. . . . . *..maintenance control section*

MCTNS. . . . . *..man-portable common thermal night sigh* t

MEDSOM. . . . . *..medical supply, optional and maintenance*

METT. . . . . *mission, enemy, terrain, and troops*

METT-T . . . . . *..mission. enemy, terrain, troops and time available*

MI ..... *..military intelligence*

MILSTAMP . . . ., ...*Military Standard Transportation and Movement Procedures*

MILSTRIP. . . . . ..*Military Standard Requisitioning and Issue Procedures*

MLH . . . .*medium lift helicopter*

MLRS. . . . . ..*multiple launch rocket system*

MMC. . . . . ..*materiel management center*

MOGAS. . . . . ..*motor gasoline*

MOPP. . . . . ..*mission oriented protective posture*

MOU. . . . . ..*memorandum of understanding*

MP. . . . . ..*military police*

MPL. . . . . ..*mandatory parts list*

MRM. . . . . ..*maintenance reporting and management*

MRO. . . . . ..*materiel release order*

MSB. . . . . ..*main support battalion*

MSR. . . . . ..*main supply route*

MST. . . . . ..*maintenance support team*

MTOE. . . . . ..*modification table of organization and equipment*

MWO. . . . . *modification work order*

NATO. . . . . .. *North Atlantic Treaty Organization*

NBC. . . . . ..*nuclear. biological, and chemical*

NCO. . . . . ..*noncommissioned officer*

NCOIC. . . . . ..*noncommissioned officer in charge*

NETT. . . . . ..*new equipment training team*

NICP. . . . . ..*national inventory control point*

NMP. . . . . ..*national maintenance point*

NSL. . . . . ..*nonstockage list*

NSN.. . . . . ..*national stock number*

OCOC... . . . . ..*on-condition oil change*

OEG. . . . . ..*operational exposure guidance*

OJT. . . . . ..*on-the-job training*

OPSEC ... .*operations security*

ORF. . . . . ..*operational readiness float*

PBO. . . . . ..*property book officer*

PC . . . .*production control*

PCB. . . . . ..*printed circuit board*

PDS. . . . . ..*personnel decontamination station*

PLL. . . . . ,...*prescribed load list*

PM. . . . . ..*preventive maintenance*

PMCS..... *preventivetive maintenance checks and services*

POL. . . . . ..*petroleum, oils and lubricants*

POMCUS . . . .*prepostioning of material configured to unit sets*

QC. . . . . ..*quality control*

QSS. . . . . ..*quick supply store*

RACO..... . . ..*rear area combat operations*

RAOC. . . . . ..*rear area operations center*

RAP. . . . . ..*rear area protection*

RSI... . . . . ..*rationalization/standardization/interoperability*

Rx. . . . . ..*reparable exchange*

SAMS. . . . . .. *Standard Army Maintenance System*

S&T. . . . . ..*supply and transport*

SASP. . . . . ..*special ammunition supply point*

SDC. . . . . ..*sample data collection*

SHORAD. . . . . ..*short-range air defense*

SLAC. . . . . ..*support list allowance card*

SLC. . . . . ..*stockage list code*

SOO. . . . . *support operations office*

SOP. . . . . *standing operating procedure*

SSA . . . .*supply support activity*

SSSC. . . . .*self-service supply center*

SST. . . . . ..*system support team*

STANAG .. . .*Standardization Agreement*

TA..... *theater Army*

TAACOM. . . . . .. *Theater Army Area Command*

TACCS. . . . . *Tactical Army Combat Service Support (CSS) Computer System*

TACOM. . . . . .. *Theater Army Command*

TAMC. . . . . ..*transportation aircraft maintenance company*

TAMMC. . . . . ..*the Army materiel management system*

TAMMS. . . . . *The Army Maintenance Management System*

TAMS . . . .*the Army maintenance system*

TDA. . . . . *..tables of distribution and allowances*

TMDE. . . . . *..test, measurement, and diagnostic equipment*

TMDE-GP . . . . . *..test, measurement, and diagnostic equipment -general purpose*

TMDE-SP . . . . . . *test, measurement, and diaganostic equipment -special purpose*

TMT . . . . . . *transportation motor transport*

TOC. . . . . *..tactical operations center*

TOE. . . . . *..table(s) of organization and equipment*

UIC. . . . . *..unit identification code*

ULLS. . . . . . *unit load logistics system*

USACC . . . . . . *United States Army Communications Command*

USAMCC. . . . . *United States Army Metrology and Calibration Center*

USATSG . . . . . . *United States Army TMDE support group*

USEUCOM . . . . . *United States European Command*

WSM. . . . . *..weapons system manager*

WSRO . . . . . . *weapons system replacement operations*

XO. . . . . *..executive officer*

REFERENCES

DA Pam 25-30 should rechecked frequently to ensure that the references listed below remain current. Each unit should obtain all regulations, technical bulletins, technical manuals, field manuals, supply bulletins, supply manuals, lubrication orders, and modification work orders pertaining to equipment used by the unit or governing procedures and techniques used by the unit.

ARMY REGULATIONS (AR)

37-108 General Accounting and Reporting for Finance and Accounting Offices

71-13 The Department of the Army Equipment Authorization and Usage Program

380-67 The Department of the Army Personnel Security Program

385-30 Safety Color Code Markings and Signs

700-4 Logistics Assistance Program

700-139 Army Warranty Program

710-1 Centralized Inventory Management of the Army Supply System

710-2 Supply Policy Below the Wholesale Level

735-5 Accounting for Lost, Damaged, and Destroyed Property

750-1 Army Materiel Maintenance

750-10 Modification of Materiel and Issuing Safety-of-Use Messages and Commercial Vehicle Safety Recall Campaign Directives

750-25 Army Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Repair Support Program

750-43 Test, Measurement and Diagnostic Equipment

DEPARTMENT OF THE ARMY FORMS (DA FORMS)

2402 Exchange Tag

2404 Equipment Inspection and Maintenance Worksheet

2407 Maintenance Request

2407-1 Maintenance Request - Continuation Sheet

2408-20 Oil Analysis Log

2416 Calibration Data

3254-R Oil Analysis Recommendation and Feedback

3758 Calibration and Repair Requirements Worksheet

3953 Purchase Request and Commitment

DEPARTMENT OF THE ARMY PAMPHLETS (DA PAM)

25-30 Consolidated Index of Army Publications and Blank Forms

385-1 Unit Safety Management

420-90 Fire Protection

600-55 Motor Vehicle Driver and Equipment Operator Selection, Training, Testing and Licensing

640-15 Criteria for Insuring the Competency of Personnel to Install, Maintain, and Repair Communications and Security Equipment

710-2-1 Using Unit Supply System (Manual Procedures)

710-2-2 Supply Support Activity (SSA) Supply System (Manual Procedures)

700-18 Provisioning of US Army Equipment

700-120 Materiel Distribution Management for Major Items

700-139 Army Warranty Program Concepts and Policies

725-50 Requisitioning, Receipt, and Issue System

735-5 Policies and Procedures for Property Accountability

738-750 The Army Maintenance Management System (TAMMS)

750-10 US Army Equipment Index of Modification Work Orders

750-35 Functional Users Guide for Motor Pool Operations

DEPARTMENT OF THE DEFENSE FORMS (DD FORM)

314 Preventive Maintenance Schedule and Record

2026 Oil Analysis Request

FIELD MANUALS (FM)

3-3 NBC Contamination Avoidance

3-5 NBC Decontamination

9-207 operation and Maintenance of Ordnance Materiel in Cold Weather

11-50 Combat Communications Within the Division

20-22 Vehicle Recovery Operation

43-5 Unit Maintenance Operations

55-40 Army Computer System Air Transport Operations

55-413 AeriaI Recovery of US Army and Air Force Aircraft

63-2-2 Combat Service Support Operations: Armored, Mechanized, and Motorized Divisions

63-20 Forward Support Battalion

63-21 Main Support Battalion

90-3 (HTF) Desert Communications (HTF)

90-5 (HTF) Jungle Operations (HTF)

90-6 (HTF) Mountain Operations

90-10 (HTF) Military Operations in Urbanized Terrain (MOUT) (HTF)

100-2(TBP) Soviet Army

100-2-1 Soviet Army Operations and Tactics

100-2-2 Soviet Army Specialized Warfare and Rear Area Support

100-2-3 Soviet Army Troops, Organization, and Equipment

100-5 Operations

100-10 Combat Service Support

TECHNICAL BULLETINS (TB)

43-180 Calibration and Repair Requirements for the Maintenance of Army Materiel

43-0210 Nonaeronautical Equipment Army Oil Analysis Program (AOAP)

43-0239 Maintenance in the Desert 380-41 Procedures for Safeguarding, Accounting and Supply Control of COMSEC Materiel, Vol 1, General Information and Guidelines

750-25 Maintenance of Supplies and Equipment: Army Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Repair Support Program

TECHNICAL MANUALS (TM)

10-277 Chemical, Toxicological and Missile Fuel Handlers Protective Clothing

38-450 Storage and Maintenance of Preposterous Materiel Configured to Unit Sets (POMCCUS)

38-L21-12 Aviation Equipment

38-L32-series Functional Users Manual For Direct Support Unit Standard Supply System

TRAINING CIRCULAR (TCs)

43-35 Unit Maintenance Management system (UMMS)

Index

Accident Reporting, 10-2
Air Defense System, 6-1
Airborne/Air Assualt Division Maintenance, 2-13
Aicraft Maintenance, 2-15
Ammunition Failures, 7-3
Armed Weapons Systems, 10-5
Army
  Missle Systems, 6-1
  Oil Analysis Program (AOAP), 3-5
  Warranty Program, 3-6
Authorized Stockage List 9-2
Base Shop, 6-2
Battle
  Damage Assessment and Repair, 1-4
  Support Scenario, A-1
Booby Traps/Contamination, 10-5
Cannibalization, 2-5, 9-3
  Policy, 9-4
Carbon Monoxide, 10-4
Care and Preservation, 7-2
Centralized Control of Decentralized Operations, 2-2
Chain of Command, 10-1
Chemical Fluids, 10-4
Classification of TMDE, 3-3
Cold Weather Operations, 11-5
Commander, 10-1
Command, Control, and Communications, 4-1
Communications
  -Electronics (CE) Equipment 8-1
  Security (COMSEC) Equipment Maintenance, 8-2
Concept 7-1
Contamination
  Avoidance, 4-6
  Problems, 4-4
Controlled Exchanged, 2-5, 9-4
Corrective Action, 10-2
Conventional Ammunition Maintenance, 7-1
Countersurveilance, 4-7
Defensive Operations, 4-3
Desert Operations, 11-1
Direct Support Maintenance, 2-8
Division
  MWO Operations, 3-7
  Support Area, 2-14
Divisional TMDE Support 3-3
DMMC Procedures, 3-4
DS/GS AVIM Unit Procedures, 3-5
During Defensive Operations, 4-3
Electronic Safety, 10-4
Electromagnetic Pulse (EMP), 8-3

EMP Damage, 8-4
Ensure Unit Equipment is Available, 2-6
Environmental
Effects on Equipment 11-2
Impact on Maintenance Operations, 11-1
Equipment
Operations, 10-3
Operator Selection, Training and Licensing, 10-2
Evacuation, 5-3
Operations, 5-4
Principles, 5-4
Explosives Safety, 10-3
Fabrication,9-4
Fact Finding, 10-2
Fire Prevention, 10-2
Formal Logistics Assistance Program, 3-2
Food and Water, 10-5
Guidance, 7-1
Hazardous Materials, 10-3
Horseplay, 10-4
Implementing Battle Damage Assessment and Repair, 2-5
Individual, 10-1
Information Security, 4-7
Jungle Operations, 11-8
Land Combat Systems, 6-1
Laser Beam, 10-4
Lifting Devices, 10-5
Light Infantry Division Maintenance, 2-14
Local Purchase, 9-4
Logistics Intelligence File (LIF), 9-3
Maintenance, 11-4
Allocation Chart 1-3
Assistance and Instruction Team Program (MAIT), 3-2
Concepts, 1-1
Functions, 8-1
In the Brigade Support Area (Heavy Division), 2-9
In the Division Support Area (Heavy Division), 2-10
Is a Command Responsibility, 2-4
Management 1-1
Management Within the Division, 2-12
Operations, 8-2
Organizations, 8-1
Overview, 1-1
Support, 2-1
Support Concept, 2-1
Support of Defensive Operations, 4-3
Support of Offensive Operations, 4-1
Support & Team, 6-2
Responsibilities, 6-2
Time Guidlines, 2-4
Units, 4-1
Mark Vehicles and Equipment to Protect Others, 4-5
Missile
Maintenance, 6-1
Maintenance Interface with Ammunition Units, 6-3
Maintenance Support 6-2
Mission Essential Maintenance Operations (MEMO), 2-5
Mission Oriented Protective Posture (MOPP), 10-5
Modified Work Orders, 3-6
Mountain Operations, 11-9
NBC Considerations (Impact on Maintenance), 4-4
Night Operations, 4-6
Nose Safety, 10-4
Operations Security, 4-6
OPSEC
Planning, 4-7
Phases, 4-6
Organization
For Support, 5-1, 5-4
For Spt Maint Fwd of the Bde Spt Area (Heavy Div), 2-6
For Transportation Operations, 5-5
Organizational Flexibility, 2-6
Other Sources of Supply, 9-3
Painting, 10-5

Physical Security, 4-6
Preparation, 11-1
Prescribed Load List, 9-1
Preventative Measures, 8-4
Principles
For Contamination Control, 4-4
Of Transportation, 5-6
Procedures, 3-5
Provide Protection From Contaminated Equipment, 4-5
Quality Control, 10-2
Radiant Light, 11-3
Radiation Safety, 10-4
Reconstitution, 4-7
Operations, 4-7
Process, 4-7
Recovery, 5-1
And Evacuation, 5-1
Operations, 5-2
Principles, 5-1
Repair
As Far Forward as Possible, 2-6
Only as needed, 2-6
Versus Recovery, 2-4
Reparable Exchange, 9-2
Safety
Color Code Markings and Signs, 10-5
Hazards and Precautions, 10-2
Responsibilities, 10-1
Sanitation/ Hygiene, 10-5
Selecting Repair Locations, 2-4
Shop Cleanliness, 10-5
Special
Clothing and Equipment, 10-3
Considerations, 5-3, 5-4
Standing Operating Procedures, 10-1
Static Electricity, 11-4
Storage, Handling, and Safety, 7-2
Supervisor Meetings, 10-1
supply
Operations, 9-1
Support Operations, 9-1
System Levels, 9-1
Support, 5-1
From A Contaminated Area, 4-6
Procedures For Defensive Operations, 4-3
Procedures For Ground Operations, 4-2
Variations Based on Tactical Situation, 4-1
Supporting Contaminated Equipment & From A Clean Area, 4-5
Sustaining Support, 4-7
Technical Assistance
And External Support 3-1
support, 3-1, 7-3
Teams, 3-1
Temperature Variation, 11-4
Test, Measurement, and Diagnostic Equipment (TMDE},
Calibration and Repair, 3-2
The Impact of
Camouflage and Site Selection, 4-6
Security Requirements on Maintenance Manpower, 4-6
TMDE
Support Concepts, 3-3
Support Coordinator, 3-4
Tools, 10-5
Traffic, 10-3
Training, 4-6
Transmission Security, 4-7
Transportation, 5-5
Support 5-6
Types of Cannibalization, 9-3
Unit
Level Maintenance, 2-7
Regeneration, 4-7
Safety Council, 10-1

Safety Officer, 10-1
Safety Program, 10-1
Use Maintenance Resourses Properly, 2-6
Usinq Unit Pocedures, 3-4
Urbanized Terrain, 11-10
Warranty
Applications, 3-6
Claims, 3-6
Claims Action, 3-6
Weapons
Safety, 10-3
System Replacement Operations (WSRO), 2-5, 9-2
Winds, 11-4